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Kenneth J. Bowles  
Glenn Research Center, Cleveland, Ohio

Luis Tsuji  
Massachusetts Institute of Technology, Cambridge, Massachusetts

John Kamvouris  
University of Akron, Akron, Ohio

Gary D. Roberts  
Glenn Research Center, Cleveland, Ohio

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National Aeronautics and  
Space Administration

Glenn Research Center

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Kenneth J. Bowles  
National Aeronautics and Space Administration  
Glenn Research Center  
Cleveland, Ohio 44135

Luis Tsuji  
Massachusetts Institute of Technology  
Cambridge, Massachusetts 02139

John Kamvouris  
University of Akron  
Akron, Ohio 44325

Gary D. Roberts  
National Aeronautics and Space Administration  
Glenn Research Center  
Cleveland, Ohio 44135

## **Summary**

A cooperative program was conducted with the General Electric Aircraft Engines plant in Evendale, Ohio, to study the effects of long-term isothermal aging at elevated temperatures on compression and thermal durability properties of T650–35 fabric-reinforced PMR–15 composites. This degradation study was conducted over an approximate time period of 3½ yr. The aging temperatures were 204, 260, 288, 316, and 343 °C. Specimens of different dimensions were evaluated. Specimens with ratios of the cut edge to total surface area of 0.03 to 0.89 were fabricated and aged.

The aged and unaged specimens were tested in compression as specified in Test Method for Compressive Properties of Rigid Plastics (ASTM D695M). Thickness changes, degraded surface layer growth, weight loss, and failure modes were monitored and recorded. All property changes were thickness dependent.

## **Introduction**

Programs are under way at the NASA Glenn Research Center to develop advanced propulsion systems for 21st century aircraft. Of vital importance in the development of these propulsion systems is the use of cost-effective materials and manufacturing procedures. The current philosophy in the development of these programs is to use lightweight polymer composites in the higher temperature sections of the new engines. In some cases, the structures may be load bearing. Because of this, it is necessary to develop predictive models that describe the durability of propulsion components, made from polymer matrix composites, under extreme ambient conditions so the use of these materials as efficient propulsion system materials over the

required lifetime of the aircraft can be demonstrated. This report is focused toward developing an engineering-based description of the thermal and mechanical durability of T650–35 graphite-fabric-reinforced PMR–15 polyimide composites at temperatures ranging from 204 to 316 °C.

References 1 to 4 present and discuss room-temperature compression properties of T650–35/PMR–15 composites measured after aging at 204, 260, 288, and 316 °C. Aging times reached 26 300 hr for specimens aged at 204 °C. In reference 1, it was found that during the duration of aging at elevated temperatures the surfaces of the composite became oxidized and a damaged surface layer formed as the material lost weight. This layer was found to play an important role in the degradation of composite compression properties. Particular attention is given to those chemically induced physical changes that have the most influence of the degradation of compression properties. There is a temperature threshold for this phenomenon between 260 and 288 °C. Aging time limits for the material tested at all temperatures and specimen thicknesses can be estimated from the graphics presented for aging durations less than 4000 hr. The data were evaluated by the following: (1) thermal oxidative stability (TOS) of the composite, (2) composite compression properties, and (3) microstructural changes. In addition, the microstructurally unaltered core material was found to significantly influence the magnitude of the residual compression properties.

It was shown in reference 2 that simple linear relationships exist between the compression properties of graphite fiber-fabric-reinforced PMR–15 and the depth of the damaged surface layer that develops and grows during the period of aging. Although the surface layer is indicative of the decrease in compression properties, the central core actually supports the incurred loads. It was determined that two mechanisms were involved in the mechanical degradation: specimen surface oxidation and thermal (nonoxidative) core reactions.

The data from references 1 and 2 were used to develop empirical equations relating compression strength to aging time for specimens of different ply thicknesses. Using these equations, structural life spans can be estimated for the PMR–15 composites at any of the temperatures that were studied. The results are presented in reference 3.

Reference 4 describes a more detailed study of the degradation mechanisms that are involved in reducing the compression properties of the composite material. The mechanisms are (1) an initial weight gain from oxygen reactions with the matrix, (2) surface oxidation of the matrix at the lower temperatures with graphite fiber oxidation at higher temperatures, and (3) thermal-induced weight losses in the core material. A mathematical description is also presented.

This report presents a collection of the data from these studies relating the effects of aging on the surface layer degradation, weight loss, glass transition temperature, and dimensions of T650–35/PMR–15 composites and the resulting changes in compression properties. All of the data are presented at the end of this report in figures 1 through 27 and tables I through XIV.

## **Materials**

ICI Fiberite supplied the materials used in this study: PMR–15 polyimide composites reinforced with T650–35, 24 by 23, 8 harness, satin-weave graphite fiber fabric. The composites were fabricated by autoclave techniques at 316 °C at the General Electric facility in Evendale, Ohio. The molded surfaces exhibited roughened appearances due to the bleeder cloth that was used. The cure was followed by a freestanding postcure at 316 °C in an air-circulating oven for 16 hr. Fiber volume ratios ranged from 0.55 to 0.59 with void contents less than 2 percent. Three of the aged specimens that provided material for compression testing measured about 9 by 11 cm in length and width and were either 4, 8, or 20 plies in thickness (nominally 0.13, 0.25, and

0.75 cm, respectively). The fourth compression specimen measured about 4.6 by 2 cm in length and width and 40 plies (1.3 cm) in thickness. These dimensions were chosen to provide nominal percentages of the cut edge to total surface area of 3, 5, 12, and 50, where the total surface area consisted of both cut and molded surfaces. Specimens with higher ratios were not tested in compression. The molded surfaces were those that were in contact with the metal mold or vacuum bag during the curing process.

## **Test Procedures**

The composite materials were aged in air-circulating ovens at temperatures of 204, 260, 288, 316, and 343 °C with an airflow maintained at 100 cm<sup>3</sup>/min. The laminates were removed periodically, allowed to cool in a desiccator, weighed, and either returned to the oven or permanently removed for testing. Selected specimens were removed from the aging ovens for compression testing at different times during the aging periods. The aging time was considered completed when the weight loss exceeded 10 percent.

The compression specimens were machined using a water-cooled diamond wheel. The specimens that were tested under compression had the nominal dimensions shown in table I. All thermally aged specimen dimensions are listed in tables II through VI. Average weight losses are listed in table III. All specimens were conditioned at 125 °C for 16 hr before compression tests were conducted. All compression tests were performed as specified in Test Method for Compressive Properties of Rigid Plastics and were measured as specified in ASTM D695M. The crosshead speed was 1.2 mm/min, the test temperature was 23.3 °C, and the relative humidity was 50 percent. No end tabs were used. Strain was measured with an extensometer, and moduli were measured using strains and loads at 500 and 1500 microstrain.

The thickness changes were calculated from measurements made prior to aging and at the conclusion of aging. Because the changes that were measured were small, and because measurements of the unaged composites were made by a different person than the measurements made after aging, some inaccuracies may have been introduced into the data. Neat resin thermal and oxidative shrinkage values during long-term aging are presented in reference 4.

The layer thickness measurements were made from photomicrographs that were taken using differential interference contrast (DIC) to accent the differences in gray tones at the damage surface interface with the visibly undamaged core. The final polishing medium used in preparing the mounted specimen was a 0.05- $\mu$ m colloidal silica emulsion.

The results of this study were reported in references 1 to 4. In reference 1, the data are presented in ksi and Msi units rather than the MPa and GPa units used in this report.

## **Concluding Remarks**

For the development of lightweight materials for aircraft engine components, a study was undertaken to investigate the durability of T650–35/PMR–15 polyimide fabric composites in a high-temperature atmosphere. This was accomplished by examining the changes in the composite during thermal aging. Changes in the compression properties of the specimens during aging were measured and analyzed with their physical changes.

The data presented here indicate that the compression properties of T650–35/PMR–15 composites can be correlated with changes in the surface layer, dimensions, and weight loss induced by thermal aging.

These data would be of great value for nondestructive (NDE) monitoring of the degradation of both the surface layer and the core material to follow the degradation of the mechanical properties of these composite materials.

## References

1. Bowles, Kenneth J.; Roberts, Gary D.; and Kamvouris, John E.: Long-Term Isothermal Aging Effects on Carbon Fabric-Reinforced PMR-15 Composites—Compression Strength. ASTM Special Technical Publication 1302, 1997, pp. 175–190.
2. Bowles, Kenneth J.: Thermal and Mechanical Durability of Graphite-Fiber-Reinforced PMR-15 Composites. Proceedings of the Third International Conference on Progress in Durability Analysis of Composite Systems (NASA TM-113116), K.L. Reifsnider, David A. Dillard, and Albert H. Cardon, eds., Balkema, Rotterdam, 1998.
3. Bowles, K.J.: Predicting the Durability of PMR-15 Composites Aged at Elevated Temperatures. Recent Developments in Durability Analysis of Composite Systems, Albert H. Cardon, et al., eds., A.A. Balkema, Rotterdam, Netherlands, 2000, pp. 441–446.
4. Bowles, Kenneth J., et al.: Longtime Durability of PMR-15 Matrix Polymer at 204, 260, 288, and 316 °C. NASA/TM—2001-210602, 2001.  
<http://gltrs.grc.nasa.gov/cgi-bin/GLTRS/browse.pl?2001/TM-2001-210602.html>

TABLE I.—T650-35/PMR-15 COMPOSITE COMPRESSION  
TEST SPECIMEN NOMINAL DIMENSIONS

Specimen	Length, cm	Width, cm	Thickness, cm	Edge area, percent
T-3	8.94	10.83	0.13	2.7
T-5	8.94	10.83	.25	5.4
T-12	8.94	10.83	.75	11.9
T-50	4.61	1.80	1.30	50.3



TABLE II.— WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 204 °C

Specimen	Length, cm	Width, cm	Thickness, cm	Weight			Aging duration, hr					
				Initial, <sup>a</sup> g	Dried, g	Loss, percent	24		48		100	
							Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	8.93	10.81	0.13	19.94	19.88	0.32	19.87	0.01	19.88	0.00	19.88	0.01
	8.96	10.79	.14	19.90	19.84	.31	19.84	.01	19.84	.00	19.84	.01
	8.94	10.84	.13	18.65	18.60	.29	18.60	.01	18.60	-.01	18.60	.00
	9.02	10.85	.13	18.76	18.70	.28	18.70	.01	18.70	.00	18.70	.01
	8.92	10.81	.13	18.87	18.81	.30	18.81	.01	18.82	.00	18.81	.00
T-5	8.95	10.81	0.27	40.73	40.63	0.23	40.62	0.02	40.63	0.01	40.62	0.02
	8.92	10.81	.27	40.99	40.90	.22	40.89	.03	40.90	.02	40.89	.02
	8.92	10.82	.27	40.75	40.66	.22	40.64	.03	40.65	.02	40.65	.02
	8.94	10.81	.27	40.67	40.57	.24	40.56	.02	40.56	.01	40.56	.02
	8.96	10.78	.27	40.49	40.40	.24	40.39	.02	40.39	.01	40.39	.01
	8.97	10.80	.26	38.13	38.05	.20	38.05	.00	38.06	-.01	38.05	.00
T-12	8.93	10.74	0.69	102.55	102.38	0.17	102.28	0.10	102.28	0.10	102.27	0.11
	8.92	10.75	.69	102.48	102.31	.16	102.35	-.04	102.35	-.04	102.34	-.03
	8.95	10.79	.69	103.18	103.01	.16	102.97	.03	102.97	.03	102.96	.04
	8.91	10.80	.70	103.80	103.62	.17	103.59	.03	103.59	.03	103.58	.04
	8.90	10.80	.70	104.00	103.82	.18	103.79	.03	103.79	.03	103.78	.04
GC	6.34	0.71	1.74	12.18	12.14	0.34	12.14	0.00	12.14	0.00	12.14	0.00
	6.34	0.70	1.73	12.16	12.12	.33	12.12	.02	12.12	.01	12.12	.02
	6.34	0.70	1.71	12.04	12.00	.33	12.00	.01	12.00	.01	12.00	.02
	6.34	0.70	1.75	12.26	12.22	.34	12.22	.01	12.22	.01	12.22	.01
	6.35	0.70	1.74	12.09	12.05	.35	12.05	.01	12.05	.01	12.05	.01
	6.34	0.70	1.74	12.12	12.08	.36	12.08	.00	12.08	.00	12.08	.00
	6.34	0.70	1.74	12.04	11.99	.35	11.99	.02	11.99	.02	11.99	.02
	6.33	0.70	1.76	12.06	12.02	.35	12.01	.01	12.02	.01	12.02	.01
	6.34	0.70	1.74	12.04	12.00	.35	12.00	.00	12.00	.00	12.00	.00
	6.34	0.70	1.74	12.10	12.05	.34	12.05	.01	12.05	.01	12.05	.01
GE	10.14	0.21	1.72	5.78	5.76	0.30	5.76	0.04	5.76	0.02	5.76	0.02
	10.13	0.21	1.73	5.85	5.83	.30	5.83	.04	5.83	.03	5.83	.02
	10.14	0.21	1.74	5.70	5.69	.30	5.68	.04	5.68	.02	5.68	.02
	10.14	0.21	1.73	5.82	5.80	.31	5.80	.04	5.80	.03	5.80	.02
GP	8.90	10.14	1.74	245.52	245.14	0.15	245.13	0.00	245.12	0.01	245.06	0.03
E	9.23	1.56	0.13	2.79	2.78	0.22	2.78	0.06	2.78	0.05	2.78	0.06
	9.26	1.56	.12	2.76	2.76	.20	2.75	.08	2.75	.07	2.75	.07
	9.27	1.56	.12	2.78	2.78	.22	2.78	.08	2.78	.06	2.78	.06
	9.28	1.56	.13	2.78	2.77	.21	2.77	.07	2.77	.06	2.77	.05
T-50	4.51	1.78	1.29	16.24	16.21	0.18	16.21	0.00	16.20	0.01	16.20	0.02
	4.52	1.78	1.30	16.31	16.28	.19	16.28	.00	16.28	.00	16.28	.02
	4.51	1.78	1.30	16.23	16.20	.18	16.20	.01	16.20	.01	16.20	.02
	4.50	1.78	1.29	16.18	16.15	.18	16.15	.00	16.15	.01	16.15	.02
	4.51	1.78	1.31	16.30	16.27	.19	16.27	.01	16.27	.01	16.27	.02
	4.50	1.78	1.28	16.08	16.05	.18	16.05	.00	16.05	.01	16.05	.02
T-67	9.44	9.46	1.79	225.58	224.85	0.32	224.85	0	224.86	0.00	224.85	0

<sup>a</sup>Weight at room temperature.

TABLE II.—Continued. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 204 °C

Specimen	Aging duration, hr									
	240		500		670		1000		2000	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	19.87	0.03	19.87	0.03	19.87	0.03	19.87	0.01	19.86	0.07
	19.83	.04	19.83	.03	19.83	.03	19.84	.01	19.83	.06
	18.59	.04	18.59	.03	18.59	.03	18.57	.12	18.59	.06
	18.70	.04	18.70	.03	18.70	.05	18.70	.02	18.70	.05
	18.81	.04	18.81	.02	18.81	.03	18.81	.00	18.81	.03
T-5	40.63	0.00	40.62	0.03	40.63	0.02	40.63	0.02	-----	-----
	40.90	.01	40.89	.03	40.89	.02	40.89	.02	40.89	0.04
	40.65	.00	40.64	.03	40.65	.02	40.65	.02	40.64	.04
	40.57	.00	40.56	.02	40.56	.01	40.56	.01	40.55	.04
	40.40	-.01	40.39	.02	40.39	.01	40.39	.01	40.38	.03
	38.06	-.02	38.05	.00	38.05	.00	38.05	.00	38.05	.02
T-12	102.27	0.11	102.27	0.11	102.27	0.11	102.27	0.11	102.25	0.13
	102.35	-.03	102.34	-.03	102.34	-.03	102.34	-.03	102.32	-.01
	102.97	.04	102.97	.04	102.96	.04	102.96	.04	102.94	.06
	103.58	.04	103.58	.04	103.58	.04	103.58	.04	103.56	.06
	103.78	.03	103.77	.04	103.77	.04	103.77	.04	103.76	.06
GC	12.14	-0.01	12.14	0.00	12.14	0.00	12.14	-0.01	-----	-----
	12.12	.00	12.12	.01	12.12	.02	12.12	.00	-----	-----
	12.00	.00	12.00	.01	12.00	.01	12.00	.00	12.00	0.04
	12.22	.00	12.22	.01	12.22	.00	12.22	.00	12.22	.03
	12.05	.00	12.05	.01	12.05	.01	12.05	.00	12.05	.04
	12.08	-.01	12.08	.00	12.08	.00	12.08	-.01	12.08	.01
	11.99	.00	11.99	.01	11.99	.01	11.99	.00	11.99	.02
	12.02	.00	12.02	.00	12.02	.00	12.02	.00	12.02	.00
	12.00	.00	12.00	-.01	12.00	-.01	12.00	-.02	12.00	-.01
	12.05	.01	12.05	0	12.05	.00	12.06	-.01	12.05	.00
GE	5.76	0.01	5.76	0.02	5.76	-0.03	5.76	0.00	5.76	0.02
	5.83	.00	5.83	.03	5.83	-.03	5.83	.00	5.83	.02
	5.69	.01	5.69	.02	5.69	-.03	5.69	-.02	5.69	.02
	5.80	.01	5.80	.01	5.80	-.03	5.80	-.02	5.80	.01
GP	244.98	0.07	244.91	0.09	244.87	0.11	244.82	0.13	244.75	0.16
E	2.78	0.00	2.78	0.11	2.78	0.12	2.78	0.05	2.78	0.14
	2.75	.01	2.75	.13	2.75	.13	2.75	.07	2.75	.16
	2.78	.01	2.78	.09	2.78	.10	2.78	.07	2.77	.15
	2.77	.01	2.77	.11	2.77	.11	2.77	.05	2.77	.14
T-50	16.20	0.02	16.20	0.04	16.20	0.04	16.20	0.03	16.20	0.06
	16.28	.01	16.27	.03	16.27	.04	16.27	.03	16.27	.06
	16.20	.02	16.19	.04	16.19	.04	16.19	.03	16.19	.06
	16.15	.02	16.15	.03	16.15	.04	16.15	.03	16.15	.05
	16.27	.02	16.27	.04	16.27	.04	16.27	.04	16.26	.06
	16.05	.02	16.05	.03	16.05	.04	16.05	.03	16.05	.05
T-67	224.84	0.00	224.85	0	224.83	0.01	224.83	0.01	224.80	0.02

TABLE II.—Continued. WEIGHT LOSS OF T650–35/PMR–15 AFTER AGING AT 204 °C

Specimen	Aging duration, hr									
	2600		3740		5000		7200		10 000	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	19.85	0.13	19.85	0.14	19.84	0.21	-----	-----	-----	-----
	19.82	.11	19.81	.16	19.79	.23	19.77	0.34	19.74	0.52
	18.58	.10	18.57	.13	18.56	.18	18.54	.28	18.51	.47
	18.69	.10	18.68	.13	18.67	.17	18.65	.29	18.61	.48
	18.80	.07	18.80	.10	18.78	.17	18.75	.32	18.68	.70
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	40.64	0.05	40.63	0.07	40.62	0.08	-----	-----	-----	-----
	40.55	.05	40.54	.07	40.54	.08	40.49	0.20	40.41	0.38
	40.38	.04	40.37	.07	40.37	.08	40.32	.18	40.24	.39
	38.04	.03	38.03	.06	38.03	.07	37.97	.23	37.89	.44
T-12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	102.24	0.13	102.22	0.15	102.21	0.17	-----	-----	-----	-----
	102.31	.00	102.30	.02	102.28	.03	102.25	0.06	102.17	0.14
	102.94	.07	102.92	.09	102.90	.11	102.86	.14	102.78	.22
	103.55	.07	103.53	.08	103.51	.10	103.48	.13	103.40	.21
103.75	.07	103.73	.08	103.71	.10	103.68	.13	103.59	.22	
GC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	12.04	0.06	12.04	0.12	12.03	0.20	-----	-----	-----	-----
	12.07	.03	12.07	.09	12.06	.15	-----	-----	-----	-----
	11.99	.04	11.98	.09	11.97	.16	11.96	0.32	11.92	0.59
	12.01	.02	12.01	.08	12.00	.14	11.98	.31	11.95	.58
	12.00	.01	11.99	.06	11.99	.10	11.97	.28	11.93	.59
12.05	.01	12.05	.05	12.04	.08	12.02	.30	11.98	.59	
GE	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	5.83	0.06	5.82	0.12	5.81	0.29	-----	-----	-----	-----
	5.68	.06	5.68	.12	5.67	.28	5.63	1.04	5.57	2.00
5.80	.04	5.79	.11	5.78	.25	5.74	0.94	5.69	1.88	
GP	244.72	0.17	244.69	.18	244.66	0.20	244.59	0.22	244.44	0.29
E	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.75	0.19	2.75	0.25	2.75	0.29	-----	-----	-----	-----
	2.77	.17	2.77	.23	2.77	.24	2.77	0.45	2.76	0.71
2.77	.18	2.76	.25	2.76	.28	2.76	.48	2.75	.77	
T-50	16.19	0.07	16.19	0.11	16.18	0.18	-----	-----	-----	-----
	16.27	.07	16.26	.11	16.25	.17	-----	-----	-----	-----
	16.19	.07	16.18	.11	16.17	.16	-----	-----	-----	-----
	16.14	.06	16.14	.09	16.13	.14	16.12	0.22	16.10	0.35
	16.26	.07	16.26	.10	16.25	.15	16.24	.23	16.21	.36
	16.05	.06	16.04	.10	16.03	.14	16.02	.22	16.00	.35
T-67	224.78	0.03	224.74	0.05	224.70	0.07	224.66	0.08	224.62	0.10

TABLE II.—Continued. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 204 °C

Specimen	Aging duration, hr									
	11 350 hr		12 330		13 460		14 680		15 830	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	19.71	0.63	19.68	0.79	19.65	0.96	19.62	1.12	19.55	1.45
	18.49	.57	18.47	.70	18.44	.85	18.41	0.99	18.37	1.23
	18.59	.59	18.57	.71	18.54	.86	18.51	1.02	18.47	1.25
	18.64	.94	18.60	1.15	18.54	1.45	18.48	1.75	18.44	2.01
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	40.20	0.49	40.19	0.51	40.12	0.69	-----	-----	-----	-----
	37.85	.54	37.84	.56	37.77	.74	37.72	0.87	37.69	0.95
T-12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	102.11	0.19	102.05	0.26	102.01	0.29	-----	-----	-----	-----
	102.72	.28	102.65	.34	102.61	.38	102.54	0.45	102.44	0.55
	103.35	.26	103.28	.33	103.24	.37	103.18	.43	103.07	.53
	103.54	.27	103.47	.34	103.41	.39	103.35	.45	103.24	.55
GC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	11.90	0.77	11.87	1.05	11.85	1.21	11.82	1.42	11.77	1.84
	11.92	.77	11.89	1.05	11.87	1.21	11.85	1.40	11.80	1.81
	11.91	.77	11.88	1.03	11.86	1.20	11.83	1.42	11.79	1.81
	11.96	.80	11.93	1.02	11.92	1.15	11.89	1.39	11.84	1.74
GE	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	5.54	2.52	5.53	2.75	5.51	3.14	5.49	3.51	5.47	3.78
	5.66	2.40	5.64	2.65	5.62	3.05	5.60	3.41	5.58	3.69
GP	244.31	0.34	244.22	0.38	244.11	0.42	243.97	0.48	243.78	0.55
E	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.75	0.95	2.75	1.02	2.75	1.21	2.74	1.49	2.73	1.68
	2.74	.97	2.74	1.01	2.74	1.23	2.73	1.51	2.72	1.66
T-50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	16.08	0.45	16.06	0.57	16.05	0.64	16.03	0.76	16.00	0.97
	16.20	.44	16.18	.59	16.17	.66	16.15	.77	16.11	.98
	15.98	.44	15.96	.57	15.95	.65	15.94	.74	15.90	.95
T-67	224.58	0.12	224.55	0.13	224.53	0.14	224.51	0.15	224.48	0.16

TABLE II.—Concluded. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 204 °C

Specimen	Aging duration, hr							
	17 720		20 000		22 590		26 300	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	18.33	1.42	-----	-----	-----	-----	-----	-----
	18.44	1.42	18.38	1.75	18.32	2.05	18.14	3.01
	18.39	2.26	18.33	2.58	18.27	2.91	18.07	3.94
T-5	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	37.64	1.09	37.57	1.28	37.47	1.53	37.12	2.44
T-12	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	102.94	0.65	-----	-----	-----	-----	-----	-----
	103.10	.69	102.93	0.85	102.64	1.13	102.02	1.73
GC	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	11.75	2.23	11.68	2.77	11.59	3.51	11.47	4.57
	11.72	2.33	11.65	2.89	11.57	3.62	11.44	4.65
	11.79	2.22	11.72	2.75	11.63	3.49	11.51	4.54
GE	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	5.45	4.08	5.44	4.41	5.42	4.74	5.34	6.08
	5.57	4.01	5.55	4.34	5.53	4.69	5.45	6.01
GP	243.51	0.66	243.21	0.79	242.78	0.96	241.62	1.44
E	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	2.73	1.86	-----	-----	2.71	2.50	2.69	3.23
	2.72	1.86	-----	-----	2.70	2.49	2.68	3.23
T-50	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----
	15.96	1.18	15.92	1.44	15.85	1.86	15.74	2.55
	16.07	1.22	16.03	1.51	15.96	1.92	15.85	2.62
	15.86	1.21	15.82	1.44	15.76	1.83	15.65	2.52
T-67	224.43	0.19	224.38	0.21	224.34	0.23	224.17	0.30

TABLE III.—WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 260 °C

Specimen	Length, cm	Width, cm	Thickness, cm	Weight			Aging duration, hr					
				Initial, <sup>a</sup> g	Dried, g	Loss, percent	24		48		100	
							Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	8.94	10.80	0.13	19.99	19.93	0.29	19.92	0.06	19.92	0.03	19.91	0.09
	8.97	10.83	.14	20.07	20.01	.29	20.00	.05	20.00	.03	19.99	.08
	8.97	10.80	.13	18.60	18.56	.25	18.55	.05	18.55	.03	18.54	.07
	8.95	10.80	.13	18.99	18.93	.29	18.92	.05	18.93	.03	18.92	.08
	8.91	10.82	.13	18.84	18.79	.27	18.78	.05	18.78	.03	18.77	.07
T-5	8.93	10.80	0.27	40.62	40.52	0.25	40.51	0.02	40.51	0.03	40.50	0.05
	8.95	10.81	.27	40.91	40.81	.24	40.80	.02	40.80	.03	40.79	.05
	8.92	10.80	.28	40.99	40.89	.23	40.89	.02	40.88	.03	40.87	.05
	8.92	10.81	.27	40.98	40.89	.23	40.88	.02	40.88	.03	40.87	.05
	8.92	10.81	.28	40.97	40.87	.24	40.86	.03	40.86	.04	40.85	.06
	8.94	10.81	.27	40.87	40.77	.24	40.76	.03	40.75	.04	40.75	.06
	8.94	10.83	.27	41.05	40.95	.24	40.94	.02	40.94	.03	40.92	.06
	8.93	10.80	.26	38.49	38.42	.19	38.41	.02	38.41	.03	38.40	.05
T-12	8.90	10.79	0.69	102.86	102.69	0.16	102.64	0.05	102.63	0.06	102.60	0.09
	8.92	10.81	.69	103.23	103.06	.16	103.01	.05	102.99	.06	102.97	.09
	8.91	10.83	.69	102.95	102.78	.16	102.73	.05	102.72	.06	102.69	.09
	8.91	10.81	.70	103.54	103.37	.17	103.32	.05	103.31	.06	103.28	.09
	8.91	10.81	.70	103.68	103.51	.16	103.46	.05	103.44	.06	103.42	.09
GC	6.34	0.71	1.74	12.21	12.17	0.33	12.16	0.04	12.16	0.07	12.16	0.08
	6.34	0.71	1.73	12.18	12.15	.32	12.14	.05	12.14	.07	12.13	.09
	6.34	0.71	1.74	12.23	12.19	.33	12.19	.05	12.19	.07	12.18	.09
	6.34	0.70	1.73	12.15	12.11	.32	12.10	.05	12.10	.06	12.10	.08
	6.34	0.70	1.74	12.14	12.11	.32	12.10	.05	12.10	.06	12.10	.08
	6.34	0.70	1.70	11.76	11.73	.28	11.73	.05	11.72	.06	11.72	.08
	6.34	0.70	1.74	12.16	12.11	.34	12.11	.05	12.11	.05	12.10	.08
	6.34	0.70	1.70	11.82	11.79	.30	11.78	.05	11.78	.06	11.78	.08
	6.34	0.70	1.75	12.15	12.11	.34	12.10	.05	12.10	.05	12.10	.07
	6.34	0.70	1.74	12.16	12.12	.34	12.12	.05	12.12	.05	12.11	.07
	6.34	0.66	1.71	11.19	11.15	.32	11.15	.04	11.14	.05	11.14	.07
	6.34	0.65	1.71	10.96	10.93	.30	10.92	.05	10.92	.05	10.92	.08
	GE	10.14	0.21	1.72	5.76	5.74	0.31	5.73	0.07	5.73	0.10	5.73
10.15		0.21	1.73	5.81	5.79	.31	5.79	.06	5.78	.09	5.78	.17
10.16		0.22	1.74	5.98	5.96	.30	5.95	.08	5.95	.10	5.95	.18
10.15		0.21	1.74	5.54	5.52	.28	5.52	.09	5.52	.12	5.51	.20
10.14		0.21	1.74	5.86	5.84	.31	5.83	.07	5.83	.10	5.83	.18
GP	8.84	10.15	1.72	242.74	242.38	0.15	242.32	0.02	242.27	0.05	242.18	0.08
E	9.23	1.56	0.12	2.76	2.76	0.22	2.76	0.07	2.76	0.08	2.75	0.15
	9.28	1.56	.12	2.80	2.79	.23	2.79	.08	2.79	.09	2.79	.16
	9.30	1.56	.13	2.79	2.78	.23	2.78	.06	2.78	.08	2.78	.14
	9.29	1.57	.12	2.79	2.79	.23	2.79	.07	2.79	.08	2.78	.15
	9.30	1.56	.12	2.76	2.75	.21	2.75	.08	2.75	.07	2.75	.12
T-50	4.52	1.78	1.31	16.26	16.24	0.17	16.23	0.04	16.23	0.06	16.22	0.09
	4.52	1.78	1.31	16.30	16.27	.17	16.27	.04	16.26	.07	16.26	.09
	4.52	1.78	1.30	16.25	16.22	.17	16.21	.04	16.21	.07	16.21	.09
	4.52	1.78	1.30	16.30	16.28	.17	16.27	.04	16.26	.07	16.26	.09
	4.51	1.78	1.29	16.18	16.15	.17	16.14	.04	16.14	.07	16.14	.09
	4.51	1.78	1.29	16.19	16.16	.17	16.15	.04	16.15	.07	16.14	.09
	4.52	1.79	1.31	16.38	16.35	.18	16.34	.04	16.34	.07	16.33	.09
	4.51	1.78	1.30	16.27	16.25	.17	16.24	.04	16.23	.07	16.23	.08
	4.50	1.78	1.29	16.14	16.11	.17	16.10	.04	16.10	.06	16.10	.08
T-67	9.28	9.31	1.82	21.31	220.64	0.30	220.62	0.01	220.59	0.02	220.58	0.03

<sup>a</sup>Weight at room temperature.

TABLE III.—Continued. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 260 °C

Specimen	Aging duration, hr									
	240		500		670		1000		2000	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	19.88	0.23	19.86	0.33	19.85	0.38	19.84	0.46	19.78	0.73
	19.96	.23	19.94	.36	19.93	.40	19.92	.47	19.87	.71
	18.52	.20	18.50	.29	18.50	.32	18.49	.37	18.46	.54
	18.90	.19	18.88	.28	18.87	.32	18.86	.36	18.83	.53
	18.75	.17	18.74	.27	18.73	.32	18.72	.34	18.69	.51
T-5	40.49	0.08	40.45	0.18	-----	-----	-----	-----	-----	-----
	40.78	.08	40.74	.18	40.74	0.18	40.72	0.23	-----	-----
	40.86	.08	40.81	.20	40.81	.20	40.79	.25	40.72	0.41
	40.86	.08	40.81	.20	40.81	.20	40.79	.25	40.71	.44
	40.84	.09	40.79	.21	40.79	.21	40.77	.26	40.68	.47
	40.73	.09	40.69	.21	40.69	.21	40.66	.27	40.57	.49
	40.91	.09	40.86	.20	40.86	.21	40.84	.27	40.76	.46
	38.39	.08	38.35	.17	38.35	.18	38.33	.24	38.26	.41
T-12	102.59	0.10	102.56	0.13	102.52	0.17	102.48	0.20	102.33	0.35
	102.96	.10	102.93	.13	102.90	.15	102.86	.20	102.69	.35
	102.68	.10	102.65	.13	102.62	.15	102.58	.20	102.42	.36
	103.27	.10	103.24	.13	103.21	.16	103.17	.19	103.02	.34
	103.40	.10	103.37	.13	103.35	.15	103.31	.19	103.15	.35
GC	12.15	0.10	12.15	0.17	-----	-----	-----	-----	-----	-----
	12.13	.11	12.12	.17	-----	-----	-----	-----	-----	-----
	12.18	.11	12.17	.17	12.16	0.24	12.15	0.37	-----	-----
	12.09	.11	12.09	.18	12.08	.25	12.06	.38	-----	-----
	12.09	.11	12.08	.18	12.08	.25	12.06	.38	12.00	0.87
	11.72	.11	11.71	.18	11.70	.25	11.69	.38	11.63	.83
	12.10	.11	12.09	.19	12.08	.26	12.07	.38	12.01	.82
	11.77	.10	11.76	.19	11.76	.25	11.74	.36	11.70	.75
	12.09	.11	12.08	.20	12.08	.26	12.06	.38	12.02	.76
	12.11	.12	12.10	.20	12.09	.26	12.08	.38	12.03	.73
	11.14	.13	11.13	.22	11.12	.25	11.11	.34	11.07	.71
10.91	.14	10.90	.23	10.90	.26	10.89	.34	10.85	.69	
GE	5.72	0.26	5.71	0.52	5.70	0.64	5.69	0.90	-----	-----
	5.77	.27	5.76	.48	5.75	.62	5.74	.88	5.65	2.46
	5.94	.28	5.93	.50	5.92	.61	5.90	.88	5.81	2.41
	5.51	.32	5.49	.54	5.49	.67	5.47	.99	5.38	2.56
	5.82	.28	5.81	.53	5.80	.63	5.78	.94	5.70	2.40
GP	242.05	0.14	241.94	0.18	241.86	0.21	241.78	0.25	241.52	0.35
E	2.75	0.24	2.75	0.38	2.75	0.43	2.74	0.51	-----	-----
	2.79	.25	2.78	.36	2.78	.43	2.78	.52	2.77	0.85
	2.78	.23	2.77	.33	2.77	.40	2.77	.50	2.76	.83
	2.78	.24	2.78	.36	2.78	.43	2.77	.52	2.76	.83
	2.74	.27	2.74	.37	2.74	.44	2.74	.51	2.73	.85
T-50	16.22	0.10	16.21	0.14	16.20	0.19	16.19	0.28	16.15	0.54
	16.26	.10	16.25	.15	16.24	.20	16.23	.28	16.19	.53
	16.20	.10	16.20	.15	16.19	.20	16.18	.28	16.14	.50
	16.26	.10	16.25	.15	16.24	.20	16.23	.28	16.20	.49
	16.13	.11	16.13	.15	16.12	.20	16.10	.28	16.07	.47
	16.14	.11	16.13	.16	16.13	.20	16.12	.27	16.09	.45
	16.33	.11	16.32	.16	16.32	.20	16.31	.26	16.27	.45
	16.23	.11	16.22	.16	16.21	.20	16.20	.25	16.17	.43
	16.09	.11	16.08	.16	16.08	.19	16.07	.25	16.04	.42
T-67	220.54	0.05	220.46	0.08	220.38	0.12	220.31	0.15	220.07	0.26

TABLE III.—Continued. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 260 °C

Specimen	Aging duration, hr									
	2600		3740		5000		6400		7200	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	19.83	0.88	19.77	1.20	19.65	1.81	-----	-----	-----	-----
	18.43	.67	18.39	0.91	18.29	1.42	18.17	2.06	18.10	2.46
	18.81	.65	18.75	.95	18.60	1.77	18.34	3.15	18.18	3.95
	18.67	.63	18.62	.91	18.46	1.72	18.21	3.08	18.06	3.87
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	40.65	0.59	40.54	0.84	40.39	1.22	-----	-----	-----	-----
	40.62	.62	40.50	.91	40.35	1.28	40.09	1.92	39.93	2.31
	40.51	.64	40.39	.94	40.25	1.29	40.00	1.89	39.84	2.29
	40.69	.63	40.56	.93	40.44	1.24	40.21	1.79	40.05	2.20
	38.21	.54	38.10	.83	37.98	1.13	37.75	1.73	37.57	2.21
T-12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	102.58	0.46	102.32	0.71	102.06	0.96	-----	-----	-----	-----
	102.31	.46	102.05	.72	101.79	.97	101.38	1.36	100.96	1.77
	102.91	.45	102.66	.69	102.41	.93	102.03	1.30	101.62	1.69
103.04	.45	102.78	.70	102.53	.95	102.11	1.35	101.68	1.76	
GC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
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	11.96	1.27	11.80	2.58	11.65	3.87	-----	-----	-----	-----
	11.65	1.15	11.53	2.14	11.38	3.42	-----	-----	-----	-----
	11.97	1.18	11.85	2.12	11.60	4.19	11.28	6.87	11.10	8.29
11.99	1.09	11.88	1.99	11.61	4.21	11.25	7.20	11.08	8.59	
11.03	1.05	10.94	1.86	10.72	3.89	10.38	6.87	10.26	8.02	
10.82	1.00	10.73	1.80	10.52	3.71	10.21	6.57	10.08	7.71	
GE	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	5.76	3.39	5.62	5.61	5.47	8.22	-----	-----	-----	-----
	5.33	3.50	5.22	5.57	5.07	8.17	4.92	10.94	-----	-----
5.65	3.30	5.53	5.30	5.37	7.97	5.21	10.79	-----	-----	
GP	241.27	0.46	240.74	0.68	240.10	0.94	239.07	1.37	238.12	1.76
E	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.75	1.04	2.74	1.49	2.73	1.88	-----	-----	-----	-----
	2.76	1.03	2.75	1.49	2.74	1.89	2.72	2.61	2.70	3.26
2.72	1.04	2.71	1.49	2.70	1.91	2.68	2.65	2.66	3.26	
T-50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	16.16	0.70	16.08	1.23	15.93	2.13	-----	-----	-----	-----
	16.04	.67	15.96	1.18	15.81	2.10	-----	-----	-----	-----
	16.06	.63	15.98	1.08	15.84	2.00	-----	-----	-----	-----
	16.25	.62	16.17	1.07	16.02	2.01	15.80	3.35	15.66	4.19
16.15	.59	16.08	1.01	15.93	1.92	15.72	3.21	15.61	3.90	
16.02	.56	15.95	.97	15.81	1.87	15.60	3.15	15.50	3.78	
T-67	219.82	0.37	219.27	0.62	218.84	0.82	218.19	1.11	217.35	1.49



TABLE III.—Continued. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 260 °C  
 [Where sections are blank, no data were obtained.]

Specimen	Aging duration, hr									
	10 000		11 350		12 330		13 460		14 680	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----				
	-----	-----	-----	-----	-----	-----				
	17.75	4.33	17.60	5.18	17.43	6.09				
	17.47	7.72	17.17	9.31	16.86	10.95				
	17.29	7.97	16.96	9.75	16.58	11.73				
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	39.30	3.84	-----	-----	-----	-----	-----	-----	-----	-----
	39.15	3.98	38.76	4.92	38.35	5.94	37.88	7.09	-----	-----
	39.36	3.88	38.99	4.77	38.60	5.73	38.13	6.88	37.54	8.32
37.04	3.60	36.67	4.55	36.29	5.54	35.90	6.55	35.43	7.79	
T-12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	99.68	3.02	99.14	3.54	98.44	4.22	97.43	5.21	96.13	6.47
	100.51	2.77	100.03	3.23	99.40	3.85	98.51	4.70	97.30	5.88
	100.48	2.93	99.96	3.42	99.30	4.06	98.38	4.95	97.03	6.25
GC	-----	-----								
	-----	-----								
	-----	-----								
	-----	-----								
	-----	-----								
	10.70	11.67								
10.69	11.85									
9.93	10.98									
9.77	10.55									
GE										
GP	235.13	2.99	233.91	3.49	232.44	4.10	230.01	5.10	228.02	5.92
E	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.64	5.23	2.62	6.18	2.59	7.14	2.55	8.61	2.50	10.33
2.61	5.22	2.58	6.17	2.55	7.12	2.51	8.59	2.47	10.37	
T-50	-----	-----								
	-----	-----								
	-----	-----								
	15.26	6.66								
15.23	6.23									
15.18	5.75									
T-67	215.04	2.54	213.88	3.06	212.64	3.63	210.61	4.55	208.72	5.40

TABLE III.—Concluded. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 260 °C  
 [Where sections are blank, no data were obtained.]

Specimen	Aging duration, hr					
	15 830		17 720		20 000	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3						
T-5	----- ----- ----- ----- ----- 36.96 34.94	----- ----- ----- ----- ----- 9.74 9.06	----- ----- ----- ----- ----- 36.14 34.20	----- ----- ----- ----- ----- 11.75 10.98	----- ----- ----- ----- ----- ----- 33.16	----- ----- ----- ----- ----- ----- 13.69
T-12	----- ----- 95.33 96.61 96.27	----- ----- 7.25 6.55 6.99	----- ----- ----- 94.88 94.40	----- ----- ----- 8.21 8.80	----- ----- ----- ----- 92.20	----- ----- ----- ----- 10.92
GC						
GE						
GP	225.28	7.06	221.22	8.73	216.83	10.54
E						
T-50						
T-67	206.59	6.37	203.58	7.73	198.00	10.26

TABLE IV.—WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 288 °C

Specimen	Length, cm	Width, cm	Thickness, cm	Weight			Aging duration, hr					
				Initial, <sup>a</sup> g	Dried, g	Loss, percent	24		48		100	
							Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	8.93	10.81	0.13	20.09	20.03	0.29	20.01	0.09	20.01	0.12	20.00	0.18
	8.95	10.82	.05	18.56	18.51	.24	18.50	.07	18.49	.11	18.48	.16
	8.93	10.81	.05	18.59	18.54	.24	18.53	.08	18.52	.11	18.51	.17
	8.95	10.83	.05	18.73	18.68	.27	18.67	.07	18.66	.10	18.65	.17
	8.94	10.81	.05	18.88	18.83	.26	18.81	.06	18.81	.10	18.79	.17
T-5	8.95	10.82	0.11	40.89	40.80	0.22	40.78	0.05	40.78	0.05	40.75	0.13
	8.92	10.81	.11	40.79	40.70	.22	40.67	.06	40.67	.06	40.64	.13
	8.95	10.81	.11	40.91	40.82	.22	40.80	.06	40.80	.06	40.77	.13
	8.95	10.81	.11	40.81	40.72	.22	40.70	.05	40.69	.06	40.66	.13
	8.92	10.81	.11	40.76	40.66	.23	40.64	.05	40.64	.06	40.61	.13
	8.92	10.81	.11	40.80	40.70	.23	40.68	.05	40.68	.07	40.65	.14
	8.94	10.82	.10	38.55	38.48	.19	38.46	.05	38.46	.06	38.43	.13
T-12	8.91	10.79	0.27	102.75	102.58	0.16	102.52	0.06	102.50	0.08	102.47	0.12
	8.92	10.78	.27	102.80	102.64	.15	102.56	.07	102.54	.10	102.51	.13
	8.93	10.79	.27	103.03	102.86	.16	102.79	.06	102.77	.09	102.75	.11
	8.93	10.80	.27	103.10	102.93	.16	102.86	.07	102.84	.09	102.81	.12
	8.91	10.80	.28	103.96	103.78	.17	103.72	.06	103.69	.08	103.66	.11
GC	6.34	0.71	0.68	12.17	12.13	0.33	12.12	0.06	12.12	0.09	12.11	0.12
	6.34	.71	.69	12.15	12.11	.34	12.10	.06	12.10	.09	12.09	.12
	6.35	.71	.69	12.22	12.18	.32	12.17	.07	12.17	.10	12.16	.14
	6.35	.70	.69	12.13	12.09	.32	12.08	.08	12.08	.10	12.08	.14
	6.34	.71	.69	12.09	12.05	.33	12.05	.06	12.04	.09	12.04	.13
	6.36	.70	.68	11.98	11.94	.32	11.93	.07	11.93	.10	11.92	.14
	6.35	.70	.68	11.90	11.87	.33	11.86	.06	11.86	.09	11.85	.13
	6.34	.70	.69	12.08	12.03	.35	12.03	.07	12.02	.09	12.02	.13
	6.35	.71	.69	12.16	12.11	.35	12.11	.06	12.10	.08	12.10	.14
	6.34	.71	.69	12.14	12.10	.35	12.09	.06	12.09	.08	12.08	.14
	6.34	.70	.69	12.09	12.05	.35	12.04	.05	12.04	.08	12.03	.14
	6.34	.70	.68	12.00	11.95	.35	11.95	.05	11.95	.07	11.94	.14
	GE	10.14	0.21	0.68	5.81	5.79	0.30	5.79	0.13	5.78	0.17	5.78
10.14		.21	.69	5.81	5.79	.30	5.78	.14	5.78	.17	5.78	.29
10.14		.22	.69	6.00	5.98	.33	5.97	.11	5.97	.14	5.96	.25
10.14		.22	.69	5.89	5.87	.32	5.86	.11	5.86	.14	5.85	.26
10.14		.22	.69	5.96	5.94	.31	5.93	.12	5.93	.15	5.92	.26
GP	8.92	10.15	0.69	244.44	244.10	0.14	243.99	0.05	243.92	0.07	243.79	0.13
E	9.26	1.56	0.05	2.77	2.77	0.22	2.77	0.12	2.76	0.13	2.76	0.21
	9.27	1.55	.05	2.79	2.78	.24	2.78	.10	2.78	.11	2.78	.20
	9.30	1.57	.05	2.82	2.81	.25	2.81	.09	2.81	.09	2.80	.18
	9.29	1.56	.05	2.76	2.76	.21	2.76	.11	2.75	.12	2.75	.19
	9.30	1.56	.05	2.79	2.79	.22	2.78	.06	2.78	.12	2.78	.23
T-50	4.51	1.81	0.51	16.45	16.42	0.18	16.41	0.06	16.41	0.09	16.41	0.12
	4.52	1.78	.51	16.27	16.24	.17	16.23	.06	16.22	.09	16.22	.13
	4.54	1.78	.51	16.30	16.27	.17	16.26	.07	16.26	.10	16.25	.13
	4.52	1.78	.51	16.33	16.30	.18	16.29	.07	16.28	.10	16.28	.13
	4.52	1.79	.51	16.30	16.27	.18	16.26	.07	16.25	.10	16.25	.13
	4.51	1.78	.51	16.10	16.07	.17	16.06	.06	16.05	.09	16.05	.14
	4.52	1.79	.51	16.18	16.15	.17	16.14	.06	16.14	.08	16.13	.14
	4.51	1.79	.51	16.17	16.14	.17	16.13	.05	16.13	.07	16.12	.13
	4.51	1.78	.51	16.15	16.12	.17	16.12	.05	16.11	.07	16.10	.13
T-67	9.45	9.31	0.71	224.50	223.81	0.31	223.76	0.02	223.75	0.03	223.69	0.05

<sup>a</sup>Weight at room temperature.

TABLE IV.—Continued. WEIGHT LOSS OF T650–35/PMR–15 AFTER AGING AT 288 °C

Specimen	Aging duration, hr									
	240		500		670		1000		1370	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	19.97	0.32	19.94	0.46	19.92	0.56	19.87	0.79	-----	-----
	18.46	.28	18.44	.37	18.43	.46	18.40	.62	18.38	0.72
	18.49	.30	18.47	.38	18.46	.47	18.43	.62	18.41	.73
	18.63	.30	18.61	.38	18.59	.47	18.57	.59	18.55	.73
	18.77	.29	18.75	.41	18.74	.45	18.71	.63	18.69	.71
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	40.60	0.23	40.58	0.28	-----	-----	-----	-----	-----	-----
	40.73	.22	40.71	.28	40.69	0.32	40.62	0.49	-----	-----
	40.63	.21	40.61	.27	40.59	.31	40.52	.49	40.47	0.62
	40.58	.21	40.55	.27	40.53	.32	40.46	.49	40.41	.61
	40.62	.21	40.59	.28	40.57	.33	40.50	.51	40.45	.63
T-12	38.41	.18	38.38	.26	38.36	.31	38.31	.45	38.27	.55
	102.40	0.18	102.33	0.25	102.29	0.29	102.23	0.35	-----	-----
	102.45	.19	102.38	.25	102.34	.29	102.28	.35	102.18	0.44
	102.68	.18	102.61	.25	102.56	.29	102.50	.35	102.40	.45
	102.74	.19	102.67	.25	102.63	.29	102.57	.35	102.47	.45
GC	103.59	.18	103.52	.25	103.48	.29	103.42	.34	103.31	.45
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	12.15	0.20	12.13	0.40	-----	-----	-----	-----	-----	-----
	12.07	.20	12.04	.41	-----	-----	-----	-----	-----	-----
	12.03	.19	12.01	.38	11.99	0.52	11.97	0.73	-----	-----
	11.92	.19	11.89	.38	11.88	.51	11.85	.72	-----	-----
	11.84	.19	11.82	.36	11.81	.50	11.78	.71	11.73	1.17
	12.01	.18	11.99	.35	11.98	.49	11.95	.72	11.89	1.19
	12.09	.18	12.07	.33	12.06	.46	12.03	.71	11.97	1.17
	12.07	.19	12.06	.32	12.04	.45	12.01	.71	11.96	1.16
	12.03	.19	12.01	.31	12.00	.42	11.97	.68	11.92	1.09
	11.93	.19	11.92	.31	11.91	.40	11.87	.68	11.83	1.03
GE	5.77	0.46	5.75	0.73	-----	-----	-----	-----	-----	-----
	5.76	.51	5.74	.84	5.73	1.15	5.67	2.05	-----	-----
	5.95	.45	5.93	.77	5.91	1.08	5.86	1.96	5.82	2.69
	5.84	.46	5.82	.85	5.80	1.16	5.75	1.98	5.71	2.79
	5.91	.45	5.89	.84	5.87	1.16	5.82	2.02	5.77	2.79
GP	243.59	0.21	243.43	0.27	243.33	0.32	243.21	0.36	243.02	0.44
E	2.76	0.35	2.75	0.56	-----	-----	-----	-----	-----	-----
	2.77	.32	2.77	.53	2.76	0.64	2.76	0.81	-----	-----
	2.80	.30	2.80	.51	2.79	.62	2.79	.79	2.78	0.98
	2.75	.32	2.74	.51	2.74	.63	2.74	.79	2.73	.97
	2.78	.37	2.77	.55	2.77	.65	2.76	.81	2.76	.99
T-50	16.40	0.16	16.38	0.27	16.37	0.36	16.35	0.46	-----	-----
	16.21	.17	16.19	.29	16.18	.38	16.16	.49	-----	-----
	16.24	.18	16.22	.29	16.21	.38	16.19	.50	-----	-----
	16.27	.17	16.25	.30	16.24	.38	16.22	.50	16.18	0.76
	16.24	.17	16.22	.29	16.21	.37	16.19	.49	16.14	.76
	16.04	.17	16.02	.29	16.01	.36	15.99	.49	15.95	.77
	16.12	.17	16.11	.28	16.09	.35	16.07	.49	16.03	.75
	16.12	.15	16.10	.22	16.10	.27	16.07	.43	16.03	.67
	16.10	.15	16.09	.22	16.08	.27	16.06	.43	16.02	.66
T-67	223.63	0.08	223.54	0.12	223.44	0.17	223.28	0.24	223.09	0.32

TABLE IV.—Continued. WEIGHT LOSS OF T650–35/PMR–15 AFTER AGING AT 288 °C

Specimen	Aging duration, hr									
	1680		2000		2600		2950		3120	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	18.35	0.86	18.34	0.95	-----	-----	-----	-----	-----	-----
	18.38	.87	18.36	.98	18.31	1.29	18.26	1.52	18.25	1.60
	18.52	.88	18.50	.97	18.43	1.33	18.38	1.60	18.36	1.73
	18.67	.85	18.65	.95	18.59	1.27	18.54	1.51	18.52	1.62
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	40.43	0.72	40.37	0.85	-----	-----	-----	-----	-----	-----
	40.37	.71	40.32	.83	40.21	1.12	40.13	1.31	40.09	1.41
	40.41	.72	40.36	.84	40.25	1.13	40.17	1.31	40.13	1.41
38.24	.62	38.21	.71	38.12	.94	38.06	1.10	38.02	1.19	
T-12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	102.11	0.51	102.02	0.60	-----	-----	-----	-----	-----	-----
	102.33	.52	102.23	.62	102.00	0.83	101.88	0.95	101.81	1.02
	102.40	.52	102.29	.62	102.08	.83	101.95	.95	101.88	1.02
103.24	.52	103.14	.62	102.91	.83	102.79	.96	102.71	1.03	
GC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
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	11.68	1.60	11.63	2.01	-----	-----	-----	-----	-----	-----
	11.84	1.64	11.79	2.05	-----	-----	-----	-----	-----	-----
	11.92	1.63	11.87	2.04	11.70	3.38	11.59	4.31	11.54	4.76
	11.90	1.60	11.86	1.99	11.70	3.27	11.60	4.14	11.54	4.57
	11.87	1.52	11.82	1.89	11.68	3.10	11.58	3.92	11.53	4.33
11.79	1.37	11.75	1.71	11.62	2.82	11.53	3.56	11.48	3.95	
GE	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	5.77	3.53	5.72	4.26	-----	-----	-----	-----	-----	-----
	5.66	3.57	5.61	4.36	5.49	6.42	5.42	7.63	5.39	8.16
5.72	3.60	5.68	4.36	5.55	6.46	5.48	7.68	5.45	8.21	
GP	242.86	0.51	242.68	0.58	242.21	0.77	241.93	0.89	241.78	0.95
E	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.78	1.14	2.77	1.31	-----	-----	-----	-----	-----	-----
	2.73	1.13	2.72	1.33	2.71	1.86	2.70	2.25	2.69	2.45
2.75	1.17	2.75	1.34	2.73	1.85	2.72	2.23	2.72	2.39	
T-50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	16.14	0.99	16.10	1.21	-----	-----	-----	-----	-----	-----
	16.10	1.00	16.07	1.22	-----	-----	-----	-----	-----	-----
	15.91	1.01	15.87	1.22	-----	-----	-----	-----	-----	-----
	15.99	.99	15.96	1.20	15.85	1.83	15.79	2.25	15.75	2.48
16.00	.89	15.96	1.09	15.87	1.68	15.80	2.07	15.77	2.28	
15.99	.86	15.95	1.06	15.86	1.62	15.80	1.99	15.77	2.19	
T-67	222.92	0.40	222.75	0.47	222.20	0.72	221.82	0.89	221.64	0.97

TABLE IV.—Concluded. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 288 °C

Specimen	Aging duration, hr					
	3420		3740		5000	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	18.20	1.83	18.16	2.08	17.81	3.98
	18.30	2.04	18.23	2.41	17.67	5.43
	18.47	1.91	18.41	2.20	17.92	4.82
T-5	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	40.00	1.62	39.89	1.90	39.26	3.43
	40.05	1.60	39.94	1.89	39.23	3.62
	37.97	1.33	37.88	1.57	37.33	2.98
T-12	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	101.67	1.16	101.43	1.39	100.68	2.12
	101.74	1.16	101.51	1.39	100.76	2.11
	102.56	1.18	102.31	1.41	101.54	2.15
GC	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	11.42	5.73	11.29	6.83	10.89	10.12
	11.43	5.51	11.30	6.55	10.87	10.10
	11.42	5.23	11.31	6.18	10.86	9.93
	11.38	4.79	11.28	5.66	10.72	10.35
GE	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	5.33	9.24	5.26	10.39	-----	-----
	5.38	9.33	5.32	10.48	-----	-----
GP	241.47	1.08	240.99	1.27	239.38	1.93
E	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	2.68	2.85	2.67	3.30	2.62	5.03
	2.71	2.78	2.69	3.28	2.65	5.00
T-50	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----
	15.68	2.92	15.59	3.48	15.31	5.23
	15.70	2.70	15.62	3.23	15.29	5.29
	15.71	2.58	15.63	3.10	15.27	5.32
T-67	221.22	1.16	220.86	1.32	218.85	2.22

TABLE V.—WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 316 °C

Specimen	Length, cm	Width, cm	Thickness, cm	Weight			Aging duration, hr					
				Initial, <sup>a</sup> g	Dried, g	Loss, percent	24		48		100	
							Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	8.93	10.83	0.13	19.90	19.85	0.28	19.79	0.26	19.77	0.36	19.72	0.64
	8.95	10.84	.14	20.04	19.98	.29	19.92	.28	19.90	.38	19.84	.68
	8.94	10.83	.13	18.61	18.57	.23	18.52	.24	18.51	.32	18.46	.56
	8.93	10.84	.13	18.55	18.50	.22	18.46	.25	18.44	.32	18.40	.56
	8.90	10.82	.13	18.93	18.89	.25	18.84	.25	18.82	.33	18.78	.54
T-5	8.93	10.84	0.28	40.80	40.71	0.22	40.63	0.17	40.59	0.29	40.53	0.43
	8.91	10.85	.28	40.90	40.81	.22	40.73	.19	40.68	.32	40.63	.44
	8.96	10.81	.28	41.18	41.09	.22	41.01	.20	40.96	.32	40.91	.44
	8.94	10.84	.28	40.95	40.86	.23	40.77	.21	40.73	.32	40.68	.44
	8.94	10.82	.28	41.03	40.93	.22	40.85	.21	40.80	.32	40.76	.44
	8.93	10.81	.27	40.91	40.81	.23	40.72	.22	40.68	.33	40.63	.45
	8.93	10.84	.27	40.62	40.53	.22	40.44	.22	40.40	.31	40.35	.43
	8.95	10.81	.26	38.36	38.29	.18	38.21	.22	38.17	.31	38.13	.42
T-12	8.91	10.81	0.60	103.32	103.15	0.16	102.89	0.25	102.76	0.38	102.69	0.45
	8.90	10.85	.70	103.34	103.18	.15	102.92	.25	102.80	.37	102.73	.43
	8.91	10.80	.70	102.89	102.73	.15	102.47	.25	102.35	.37	102.29	.43
	8.92	10.81	.70	103.74	103.58	.16	103.30	.26	103.18	.38	103.12	.44
	8.91	10.81	.70	103.65	103.49	.16	103.22	.25	103.10	.37	103.03	.44
GC	6.34	0.71	1.74	12.15	12.11	0.34	12.09	0.17	12.08	0.28	12.06	0.44
	6.34	0.71	1.75	12.18	12.14	.34	12.12	.17	12.10	.28	12.08	.43
	6.34	0.71	1.76	12.30	12.26	.33	12.24	.17	12.22	.28	12.21	.43
	6.36	0.71	1.75	12.15	12.11	.34	12.09	.17	12.07	.28	12.05	.43
	6.35	0.71	1.75	12.13	12.09	.34	12.07	.18	12.06	.28	12.04	.43
	6.35	0.70	1.75	12.05	12.01	.33	11.99	.18	11.98	.28	11.96	.42
	6.35	0.70	1.72	11.87	11.83	.33	11.81	.18	11.80	.27	11.78	.42
	6.36	0.70	1.72	11.87	11.83	.33	11.81	.18	11.80	.27	11.78	.42
	6.34	0.71	1.73	12.08	12.04	.34	12.01	.19	12.00	.27	11.98	.43
	6.34	0.70	1.74	11.98	11.94	.35	11.92	.19	11.91	.28	11.89	.43
	6.35	0.71	1.74	12.24	12.20	.35	12.18	.19	12.17	.27	12.15	.42
	6.34	0.71	1.74	12.14	12.10	.35	12.08	.20	12.07	.28	12.05	.43
	GE	10.14	0.21	1.74	5.89	5.87	0.31	5.84	0.41	5.84	0.52	5.81
10.14		0.21	1.75	5.81	5.79	.32	5.76	.42	5.76	.54	5.73	.93
10.14		0.22	1.75	5.94	5.92	.32	5.89	.42	5.89	.54	5.86	.92
10.14		0.21	1.74	5.84	5.83	.32	5.80	.42	5.79	.55	5.77	.91
GP	8.90	10.15	1.75	245.85	245.48	0.15	245.21	0.11	244.93	0.22	244.59	0.36
E	9.23	1.55	0.13	2.77	2.77	0.21	2.75	0.42	2.75	0.49	2.75	0.71
	9.26	1.56	.13	2.77	2.76	.21	2.75	.49	2.75	.57	2.74	.77
	9.28	1.56	.13	2.78	2.78	.22	2.76	.40	2.76	.48	2.76	.68
	9.30	1.56	.13	2.79	2.79	.24	2.78	.39	2.77	.47	2.77	.65
T-50	4.51	1.77	1.30	15.93	15.91	0.17	15.88	0.14	15.87	0.23	15.85	0.37
	4.52	1.78	1.31	16.29	16.26	.18	16.24	.15	16.22	.25	16.20	.39
	4.51	1.78	1.30	16.24	16.21	.18	16.18	.16	16.17	.25	16.14	.39
	4.51	1.79	1.29	16.14	16.11	.18	16.08	.16	16.07	.25	16.04	.40
	4.50	1.79	1.29	16.10	16.07	.18	16.04	.16	16.03	.24	16.01	.37
	4.51	1.79	1.29	16.15	16.12	.18	16.10	.17	16.08	.25	16.06	.37
	4.53	1.79	1.30	16.26	16.23	.18	16.21	.17	16.19	.25	16.17	.37
	4.52	1.79	1.31	16.34	16.31	.18	16.28	.17	16.27	.25	16.25	.37
	4.51	1.79	1.29	16.14	16.11	.17	16.08	.18	16.07	.26	16.05	.37
T-67	9.28	9.30	1.79	219.38	218.68	0.32	218.59	0.04	218.52	0.07	218.45	0.11

<sup>a</sup>Weight at room temperature.

TABLE V.—Continued. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 316 °C

Specimen	Aging duration, hr									
	240		500		670		860		1000	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	19.72	1.27	-----	-----	-----	-----	-----	-----	-----	-----
	18.37	1.06	18.19	2.02	-----	-----	-----	-----	-----	-----
	18.31	1.08	18.12	2.08	17.92	3.15	17.69	4.39	17.51	5.36
	18.70	1.00	18.54	1.84	18.39	2.65	18.19	3.70	17.98	4.80
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	40.49	0.78	-----	-----	-----	-----	-----	-----	-----	-----
	40.78	.76	40.55	1.32	-----	-----	-----	-----	-----	-----
	40.55	.75	40.33	1.28	40.04	2.00	39.67	2.90	39.38	3.62
	40.64	.72	40.43	1.24	40.14	1.94	39.77	2.85	39.45	3.62
	40.51	.74	40.31	1.24	40.03	1.92	39.63	2.88	39.29	3.72
	40.25	.68	40.06	1.15	39.81	1.76	39.47	2.62	39.15	3.39
	38.05	.64	37.90	1.02	37.74	1.44	37.54	1.95	37.37	2.41
T-12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	102.47	0.69	-----	-----	-----	-----	-----	-----	-----	-----
	102.02	.69	101.71	0.99	-----	-----	-----	-----	-----	-----
	102.84	.71	102.52	1.02	102.34	1.19	102.09	1.43	101.87	1.65
	102.74	.72	102.39	1.06	102.19	1.26	101.93	1.50	101.70	1.73
GC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	12.15	0.89	-----	-----	-----	-----	-----	-----	-----	-----
	12.00	.88	-----	-----	-----	-----	-----	-----	-----	-----
	11.99	.86	11.80	2.45	-----	-----	-----	-----	-----	-----
	11.91	.85	11.73	2.37	-----	-----	-----	-----	-----	-----
	11.73	.82	11.55	2.40	11.42	3.50	11.26	4.79	11.12	5.98
	11.74	.81	11.57	2.18	11.47	3.08	11.30	4.48	11.15	5.74
	11.94	.80	11.78	2.16	11.64	3.26	11.43	5.06	11.25	6.53
	11.84	.80	11.68	2.14	11.55	3.24	11.33	5.11	11.15	6.59
	12.11	.76	11.95	2.02	11.82	3.07	11.59	4.97	11.41	6.49
	12.01	.79	11.85	2.09	11.72	3.17	11.48	5.12	11.28	6.76
GE	5.75	2.08	-----	-----	-----	-----	-----	-----	-----	-----
	5.67	2.08	5.39	6.82	-----	-----	-----	-----	-----	-----
	5.80	2.01	5.53	6.50	5.31	10.24	5.10	13.78	-----	-----
	5.71	1.98	5.46	6.34	5.25	9.89	5.06	13.19	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
GP	243.74	0.71	242.96	1.03	242.56	1.19	242.05	1.40	241.65	1.56
E	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.73	1.24	-----	-----	-----	-----	-----	-----	-----	-----
	2.74	1.12	2.71	2.50	2.68	3.56	2.64	4.74	2.62	5.63
	2.76	1.09	2.72	2.44	2.69	3.45	2.66	4.53	2.64	5.46
T-50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	15.99	0.71	-----	-----	-----	-----	-----	-----	-----	-----
	15.96	.66	-----	-----	-----	-----	-----	-----	-----	-----
	16.02	.65	-----	-----	-----	-----	-----	-----	-----	-----
	16.13	.64	15.99	1.49	15.91	2.03	15.77	2.85	15.66	3.55
	16.21	.62	16.08	1.40	16.00	1.95	15.84	2.90	15.72	3.64
16.01	.60	15.90	1.30	15.82	1.81	15.67	2.71	15.55	3.46	
T-67	218.21	0.21	217.81	0.40	217.68	0.46	217.47	0.55	217.33	0.62



TABLE V.—Continued. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 316 °C  
 [Where sections are blank, no data were obtained.]

Specimen	Aging duration, hr									
	1180		1370		1440		1510		1730	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	-----	-----	-----	-----	-----	-----	-----	-----		
	-----	-----	-----	-----	-----	-----	-----	-----		
	-----	-----	-----	-----	-----	-----	-----	-----		
	17.77	5.91	17.34	8.17	17.20	8.94	17.09	9.54		
T-5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	39.12	4.44	38.55	5.83	38.33	6.37	38.04	7.06	37.00	9.61
	38.89	4.70	38.30	6.15	38.04	6.79	37.72	7.58	36.44	10.71
38.77	4.34	38.27	5.57	38.01	6.22	37.73	6.91	36.47	10.01	
37.13	3.04	36.86	3.73	36.69	4.19	36.52	4.63	35.70	6.77	
T-12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	101.22	2.19	100.38	3.01	99.97	3.40	99.66	3.69	98.07	5.23
GC	-----	-----	-----	-----						
	-----	-----	-----	-----						
	-----	-----	-----	-----						
	-----	-----	-----	-----						
	-----	-----	-----	-----						
	10.95	9.01	10.66	11.40						
	10.85	9.14	10.46	12.43						
11.13	8.77	10.72	12.16							
11.06	8.61	10.63	12.18							
GE										
GP	240.73	1.93	239.30	2.52	238.64	2.79	238.24	2.95	235.66	4.00
E	-----	-----	-----	-----	-----	-----	-----	-----		
	-----	-----	-----	-----	-----	-----	-----	-----		
	2.60	6.48	2.53	8.84	2.51	9.66	2.49	10.40		
2.61	6.35	2.55	8.65	2.52	9.46	2.50	10.16			
T-50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	15.46	4.74	15.23	6.22	15.12	6.83	15.03	7.44	14.71	9.37
15.52	4.86	15.24	6.58	15.14	7.22	15.03	7.85	14.64	10.27	
15.40	4.39	15.13	6.07	15.03	6.67	14.93	7.29	14.56	9.63	
T-67	217.14	0.70	216.82	0.85	216.54	0.98	216.34	1.07	215.52	1.45

TABLE V.—Concluded. WEIGHT LOSS OF  
T650-35/PMR-15 AFTER AGING AT 316 °C  
[Where sections are blank, no data were  
obtained.]

Specimen	Aging duration, hr	
	2090	
	Weight, g	Weight loss, percent
T-3		
T-5		
T-12	----- ----- ----- ----- 95.16	----- ----- ----- ----- 8.05
GC		
GE		
GP	230.66	6.04
E		
T-50		
T-67	213.83	2.22

TABLE VI.—WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 343 °C

Specimen	Length, cm	Width, cm	Thickness, cm	Weight			Aging duration, hr					
				Initial, <sup>a</sup> g	Dried, g	Loss, percent	24		48		100	
							Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	8.94	10.80	0.14	19.96	19.67	1.47	19.78	-0.58	19.73	-0.32	19.65	0.11
	8.92	10.81	.13	18.95	18.91	.23	18.80	.57	18.76	.81	18.69	1.14
T-5	8.92	10.82	0.28	40.85	40.76	0.22	40.55	0.51	40.48	0.69	40.36	0.97
	8.92	10.82	.28	40.81	40.72	.22	40.52	.50	40.45	.67	40.34	.93
	8.93	10.80	.28	40.70	40.61	.22	40.39	.52	40.33	.68	40.22	.96
	8.93	10.82	.28	40.75	40.66	.22	40.47	.46	40.40	.63	40.30	.87
T-12	8.94	10.79	0.70	103.32	103.16	0.16	102.50	0.64	102.30	0.83	102.10	1.02
	8.93	10.77	.70	103.65	103.48	.16	102.85	.61	102.64	.82	102.43	1.02
GC	6.36	0.71	1.73	12.09	12.05	0.32	12.00	0.39	11.98	0.54	11.95	0.85
	6.34	.71	1.74	12.17	12.13	.33	12.08	.40	12.06	.54	12.02	.85
	6.34	.71	1.73	12.11	12.07	.33	12.02	.40	12.00	.54	11.96	.88
	6.34	.71	1.75	12.14	12.10	.34	12.05	.41	12.03	.56	11.99	.92
	6.35	.71	1.75	12.22	12.18	.35	12.13	.39	12.11	.55	12.07	.94
	6.34	.70	1.75	12.09	12.04	.35	12.00	.40	11.98	.57	11.93	.96
	6.34	.71	1.74	12.15	12.11	.34	12.06	.40	12.04	.58	12.00	.97
	6.34	.70	1.74	12.03	11.99	.35	11.94	.41	11.92	.58	11.87	.99
	6.35	.70	1.75	12.15	12.11	.34	12.06	.39	12.04	.55	11.99	.95
GE	10.14	0.21	1.73	5.87	5.85	0.32	5.81	0.64	5.79	0.98	5.74	1.82
	10.14	.22	1.74	5.80	5.78	.32	5.75	.64	5.73	.95	5.68	1.78
GP	8.90	10.16	1.70	243.06	242.71	0.14	241.26	0.60	240.88	0.75	240.42	0.94
E	9.25	1.56	0.13	2.78	2.78	0.24	2.76	0.60	2.75	0.85	2.74	1.29
	9.28	1.55	.13	2.76	2.75	.24	2.74	.56	2.73	.81	2.72	1.20
T-50	4.52	1.78	1.30	16.23	16.20	0.18	16.14	0.42	16.10	0.61	16.06	0.89
	4.52	1.78	1.30	16.24	16.22	.18	16.15	.43	16.11	.63	16.07	.93
	4.52	1.78	1.31	16.31	16.28	.18	16.21	.43	16.18	.64	16.12	.96
T-67	9.28	9.50	1.80	222.52	221.81	0.32	221.60	0.09	221.49	0.14	221.35	0.21

<sup>a</sup>Weight at room temperature.

TABLE VI.—Concluded. WEIGHT LOSS OF T650-35/PMR-15 AFTER AGING AT 343 °C  
 [Where sections are blank, no data were obtained.]

Specimen	Aging duration, hr									
	240		360		430		500		670	
	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent	Weight, g	Weight loss, percent
T-3	----- 18.39	----- 2.73	----- 17.91	----- 5.27	----- 17.43	----- 7.83	----- 16.87	----- 10.77		
T-5	----- 39.87 39.72 39.90	----- 2.10 2.18 1.88	----- ----- 38.93 39.21	----- ----- 4.13 3.56	----- ----- 38.27 38.59	----- ----- 5.75 5.08	----- ----- 37.60 38.00	----- ----- 7.41 6.54	----- ----- ----- 36.14	----- ----- ----- 11.11
T-12	----- 101.68	----- 1.74	----- 100.44	----- 2.94	----- 99.45	----- 3.90	----- 98.33	----- 4.98	----- 94.59	----- 8.59
GC	----- ----- 11.75 11.76 11.82 11.69 11.76 11.64 11.76	----- ----- 2.59 2.81 2.95 2.97 2.93 2.96 2.88	----- ----- ----- ----- 11.44 11.32 11.41 11.29 11.42	----- ----- ----- ----- 6.10 6.03 5.84 5.82 5.67	----- ----- ----- ----- 11.14 11.04 11.14 11.03 11.16	----- ----- ----- ----- 8.56 8.37 8.06 7.99 7.86	----- ----- ----- ----- 10.79 10.70 10.80 10.70 10.82	----- ----- ----- ----- 11.38 11.19 10.83 10.81 10.67		
GE	5.44 5.39	6.95 6.77	5.07 5.04	13.29 12.93						
GP	238.99	1.53	236.78	2.44	234.93	3.21	232.78	4.09	225.66	7.02
E	2.68 2.66	3.32 3.25	2.61 2.59	5.87 5.93	2.56 2.53	7.80 8.05	2.49 2.46	10.23 10.56		
T-50	15.90 15.89 15.95	1.86 2.00 2.05	15.66 15.63 15.68	3.34 3.59 3.68	15.46 15.43 15.47	4.56 4.87 4.97	15.26 15.20 15.23	5.84 6.28 6.45	14.66 14.56 14.57	9.51 10.24 10.51
T-67	220.83	0.44	220.27	0.69	219.86	0.88	219.41	1.08	217.99	1.72

TABLE VII.— AVERAGE WEIGHT LOSS (PERCENT) OF T650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES  
 [Where sections are blank, no data were obtained.]

(a) Aging temperature, 204 °C

Specimen	Aging duration, hr												
	24	48	100	240	360	430	500	670	860	1000	1180	1370	1440
T-3	0.01	0.00	0.01	0.04			0.03	0.03		0.03			
T-5	.02	.01	.02	.00			.02	.01		.01			
T-12	.03	.03	.04	.04			.04	.04		.04			
GC	.01	.01	.01	.00			.00	.00		.00			
GE	.04	.03	.02	.01			.02	.03		-.01			
GP	.00	.01	.03	.07			.09	.11		.13			
E	.07	.06	.06	.01			.11	.11		.06			
T-50	.00	.01	.02	.02			.04	.04		.03			
T-67	.00	.00	.00	.00			.00	.01		.01			

(b) Aging temperature, 260 °C

Specimen	Aging duration, hr												
	24	48	100	240	360	430	500	670	860	1000	1180	1370	1440
T-3	0.05	0.03	0.08	0.20			0.30	0.35		0.40			
T-5	.02	.03	.05	.08			.20	.20		.25			
T-12	.05	.06	.09	.10			.13	.16		.20			
GC	.05	.06	.08	.11			.19	.25		.37			
GE	.07	.10	.18	.28			.52	.63		.92			
GP	.02	.05	.08	.14			.18	.21		.25			
E	.07	.08	.14	.25			.36	.43		.51			
T-50	.04	.07	.09	.11			.15	.20		.27			
T-67	.01	.02	.03	.05			.08	.12		.15			

(c) Aging temperature, 288 °C

Specimen	Aging duration, hr												
	24	48	100	240	360	430	500	670	860	1000	1180	1370	1440
T-3	0.07	0.11	0.17	0.30			0.40	0.48		0.65		0.72	
T-5	.05	.06	.13	.21			.27	.32		.49		.60	
T-12	.06	.09	.12	.18			.25	.29		.35		.45	
GC	.06	.09	.13	.19			.35	.47		.70		1.13	
GE	.12	.16	.27	.47			.81	1.14		.00		2.76	
GP	.05	.07	.13	.21			.27	.32		.36		.44	
E	.10	.11	.20	.33			.53	.63		.80		.98	
T-50	.06	.09	.13	.16			.27	.35		.47		.73	
T-67	.02	.03	.05	.08			.12	.17		.24		.32	

(d) Aging temperature, 316 °C

Specimen	Aging duration, hr												
	24	48	100	240	360	430	500	670	860	1000	1180	1370	1440
T-3	0.26	0.34	0.60	1.10			1.98	2.90	4.05	5.08	5.91	8.17	8.94
T-5	.21	.32	.44	.72			1.21	1.81	2.64	3.35	4.13	5.32	5.89
T-12	.26	.37	.44	.70			1.02	1.22	1.47	1.69	2.19	3.01	3.40
GC	.18	.28	.43	.83			2.23	3.22	4.92	6.35	8.88	12.04	-----
GE	.42	.54	.92	2.04			6.55	10.07	13.48	-----	-----	-----	-----
GP	.11	.22	.36	.71			1.03	1.19	1.40	1.56	1.93	2.52	2.79
E	.42	.50	.70	1.15			2.47	3.51	4.63	5.55	6.41	8.74	9.56
T-50	.16	.25	.38	.65			1.40	1.93	2.82	3.55	4.66	6.29	6.91
T-67	.04	.07	.11	.21			.40	.46	.55	.62	.70	.85	.98

(e) Aging temperature, 343 °C

Specimen	Aging duration, hr							
	24	48	100	240	360	430	500	670
T-3	-0.01	0.24	0.62	2.73	5.27	7.83	10.77	-----
T-5	.50	.67	.93	2.05	3.84	5.41	6.97	11.11
T-12	.63	.82	1.02	1.74	2.94	3.90	4.98	8.59
GC	.40	.56	.92	2.87	5.89	8.17	10.98	-----
GE	.64	.97	1.80	6.86	13.11	-----	-----	-----
GP	.60	.75	.94	1.53	2.44	3.21	4.09	7.02
E	.58	.83	1.25	3.28	5.90	7.93	10.39	-----
T-50	.42	.63	.93	1.97	3.54	4.80	6.19	10.09
T-67	.09	.14	.21	.44	.69	.88	1.08	1.72

TABLE VII.—Continued. AVERAGE WEIGHT LOSS (PERCENT) OF PMR-15/T650-35 AFTER AGING AT VARIOUS TEMPERATURES  
 [Where sections are blank, no data were obtained.]

(a) Aging temperature, 204 °C

Specimen	Aging duration, hr											
	1510	1680	1730	2000	2090	2600	2950	3120	3420	3740	5000	6400
T-3				0.05		0.13				0.13	0.19	
T-5				.03		.04				.07	.08	
T-12				.06		.07				.09	.10	
GC				.01		.03				.08	.14	
GE				.02		.05				.12	.27	
GP				.16		.17				.18	.20	
E				.15		.18				.24	.27	
T-50				.05		.07				.10	.16	
T-67				.02		.03				.05	.07	

(b) Aging temperature, 260 °C

Specimen	Aging duration, hr											
	1510	1680	1730	2000	2090	2600	2950	3120	3420	3740	5000	6400
T-3				.60		0.71				0.99	1.68	2.76
T-5				.45		.60				.89	1.23	1.83
T-12				.35		.45				.71	.95	1.34
GC				.77		1.12				2.08	3.88	6.88
GE				2.46		3.40				5.49	8.12	10.87
GP				.35		.46				.68	.94	1.37
E				.84		1.03				1.49	1.89	2.63
T-50				.48		.63				1.09	2.01	3.24
T-67				.26		.37				.62	.82	1.11

(c) Aging temperature, 288 °C

Specimen	Aging duration, hr										
	1510	1680	1730	2000	2090	2600	2950	3120	3420	3740	5000
T-3		0.87		0.96		1.30	1.54	1.65	1.93	2.23	4.75
T-5		.69		.81		1.06	1.24	1.34	1.51	1.79	3.35
T-12		.52		.61		.83	.95	1.02	1.17	1.40	2.13
GC		1.56		1.95		3.14	3.98	4.40	5.32	6.31	10.13
GE		3.57		4.33		6.44	7.66	8.18	9.29	10.43	-----
GP		.51		.58		.77	.89	.95	1.08	1.27	1.93
E		1.15		1.33		1.86	2.24	2.42	2.81	3.29	5.02
T-50		.96		1.17		1.71	2.10	2.32	2.73	3.27	5.28
T-67		.40		.47		.72	.89	.97	1.16	1.32	2.22

(d) Aging temperature, 316 °C

Specimen	Aging duration, hr				
	1510	1680	1730	2000	2090
T-3	9.54		-----		-----
T-5	6.55		9.27		-----
T-12	3.69		5.23		8.05
GC	-----		-----		-----
GE	-----		-----		-----
GP	2.95		4.00		6.04
E	10.28		-----		-----
T-50	7.53		9.75		-----
T-67	1.07		1.45		2.22

TABLE VII.—Concluded. AVERAGE WEIGHT LOSS (PERCENT) OF PMR-15/T650-35 AFTER AGING AT VARIOUS TEMPERATURES

(a) Aging temperature, 204 °C

Specimen	Aging duration, hr										
	7200	10 000	11 350	12 330	13 460	14 680	15 830	17 720	20 000	22 590	26 300
T-3	0.31	0.54	0.68	0.84	1.03	1.22	1.49	1.70	2.16	2.48	3.48
T-5	.20	.40	.51	.54	.72	.87	.95	1.09	1.28	1.53	2.44
T-12	.12	.19	.25	.32	.36	.44	.54	.67	.85	1.13	1.73
GC	.30	.59	.78	1.04	1.19	1.41	1.80	2.26	2.80	3.54	4.59
GE	.99	1.94	2.46	2.70	3.10	3.46	3.74	4.04	4.38	4.72	6.04
GP	.22	.29	.34	.38	.42	.48	.55	.66	.79	.96	1.44
E	.46	.74	.96	1.02	1.22	1.50	1.67	1.86	-----	2.49	3.23
T-50	.22	.35	.44	.58	.65	.75	.97	1.20	1.46	1.87	2.56
T-67	.08	.10	.12	.13	.14	.15	.16	.19	.21	.23	.30

(b) Aging temperature, 260 °C

Specimen	Aging duration, hr									
	7200	10 000	11 350	12 330	13 460	14 680	15 830	17 720	20 000	
T-3	3.43	6.67	8.08	9.59	-----	-----	-----	-----	-----	
T-5	2.25	3.82	4.75	5.73	6.84	8.05	9.40	11.36	13.69	
T-12	1.74	2.91	3.40	4.04	4.95	6.20	6.93	8.50	10.92	
GC	8.15	11.26	-----	-----	-----	-----	-----	-----	-----	
GE	-----	-----	-----	-----	-----	-----	-----	-----	-----	
GP	1.76	2.99	3.49	4.10	5.10	5.92	7.06	8.73	10.54	
E	3.26	5.22	6.18	7.13	8.60	10.35	-----	-----	-----	
T-50	3.96	6.22	-----	-----	-----	-----	-----	-----	-----	
T-67	1.49	2.54	3.06	3.63	4.55	5.40	6.37	7.73	10.26	

TABLE VIII.— AVERAGE COMPRESSIVE STRENGTH, MODULUS, AND STRAIN TO FAILURE OF T650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(a) Unaged										
Specimen	Aging duration, hr	Compression strength, MPa	Standard deviation	Coefficient of variation	Compression modulus, GPa	Standard deviation	Coefficient of variation	Strain at failure	Standard deviation	Coefficient of variation
T-3	0	660.20	13.95	2.10	67.78	3.24	4.80	1.10	0	0
		532.91	7.06	1.30	76.81	2.34	3.10	.80	0.06	7.50
		543.46	27.03	5.00	75.29	.14	0.20	.80	.06	7.50
T-5	0	693.50	17.12	2.50	64.81	.34	0.50	1.20	0	0
		713.91	11.67	1.60	69.02	1.10	1.60	1.20	0	0
		696.12	29.52	4.20	68.95	2.55	3.70	1.20	0.10	8.30
		686.40	53.43	7.80	64.81	2.41	3.70	1.20	.10	8.30
T-12	0	672.61	25.02	3.70	64.74	4.34	6.70	1.20	0.06	5.00
		651.92	15.79	2.40	64.95	1.38	2.10	1.20	.10	8.30
		677.64	16.30	2.40	65.23	1.86	2.90	1.30	.10	7.70
FA	0	610.69	11.49	1.90	69.85	1.24	1.80	-----	-----	-----

(b) Aging temperature, 204 °C										
T-3	5 000	427.35	6.73	1.60	70.95	1.59	2.20	0.70	0.10	14.30
	15 830	190.10	8.14	4.30	64.88	2.90	4.50	.40	.00	.00
	17 720	142.73	8.64	6.10	70.88	2.14	3.00	.30	.10	33.30
T-5	1 000	687.50	30.19	4.40	66.61	1.93	2.90	1.20	0.15	12.50
	2 000	675.23	17.48	2.60	66.67	.76	1.10	1.20	.15	12.50
	5 000	616.55	14.56	2.40	65.30	1.86	2.90	1.30	.06	4.60
	13 460	332.41	8.07	2.40	49.16	1.52	3.10	.70	0	0
T-12	13 460	580.28	21.95	3.80	62.19	0.97	1.60	1.30	0.10	7.70
	5 000	720.18	12.85	1.80	68.40	4.00	5.80	1.30	.10	7.70
	15 830	477.62	24.31	5.10	58.75	2.14	3.60	1.10	.20	18.20
	17 720	521.26	17.89	3.40	55.85	3.72	6.70	1.40	.10	7.10
T-50	5 000	503.27	14.05	2.80	68.74	6.34	9.20	-----	-----	-----

(c) Aging temperature, 260 °C										
T-3	2 000	679.78	10.25	1.50	71.85	1.17	1.60	1.10	0.10	9.10
	12 330	212.57	26.84	12.60	59.37	2.41	4.10	.60	.20	33.30
	12 330	96.87	3.38	3.50	56.47	2.83	5.00	.10	0	0
T-5	500	725.63	16.80	2.30	64.54	4.34	6.70	1.30	0	0
	1 000	724.04	12.76	1.80	65.78	3.38	5.10	1.30	0.10	7.70
	2 000	702.88	16.52	2.40	66.88	1.03	1.50	1.20	.06	5.00
	5 000	625.10	4.82	0.80	68.47	3.17	4.60	1.10	.10	9.10
	13 460	314.62	20.18	6.40	50.75	1.52	3.00	.70	.20	28.60
	17 720	233.53	21.54	9.20	45.99	.48	1.00	.60	.10	16.70
T-12	5 000	672.68	28.46	4.20	67.78	2.21	3.30	1.40	0.10	7.10
	15 830	161.89	5.10	3.10	63.23	1.31	2.10	.30	.10	33.30
	17 720	421.70	29.69	7.00	58.61	1.10	1.90	1.00	.10	10.00
T-50	2 000	497.68	22.48	4.50	69.64	1.10	1.60	-----	-----	-----
	5 000	394.60	6.87	1.70	68.61	2.00	2.90	-----	-----	-----
	10 000	188.72	32.23	17.10	0	0	-----	-----	-----	-----

(d) Aging temperature, 288 °C										
T-3	100	709.63	21.08	3.00	64.47	2.41	3.70	1.20	.06	5.00
	1 000	649.78	26.48	4.10	67.43	0.76	1.10	1.00	0.06	6.00
	2 000	491.96	22.99	4.70	75.43	0.76	1.00	.70	.10	14.30
T-5	1 000	668.95	11.93	1.80	65.09	2.76	4.20	1.20	0.06	5.00
	2 000	651.58	31.55	4.80	66.33	2.48	3.70	1.20	.10	8.30
	5 000	464.79	16.69	3.60	53.44	0.62	1.20	1.10	.10	9.10
	5 000	473.62	45.80	9.70	67.50	1.93	2.90	.90	.20	22.20
T-12	1 000	667.09	24.06	3.60	66.74	2.41	3.60	1.20	0.10	8.30
	2 000	673.71	31.79	4.70	66.81	3.24	4.90	1.30	.10	7.70
T-50	1 000	522.99	18.28	3.50	69.98	2.76	3.90	-----	-----	-----
	2 000	433.70	5.16	1.20	69.98	1.10	1.60	-----	-----	-----
	5 000	174.72	5.98	3.40	63.85	3.45	5.40	-----	-----	-----



TABLE VIII.—Concluded. COMPRESSIVE STRENGTH, MODULUS, AND STRAIN TO FAILURE OF T650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(e) Aging temperature, 316 °C

Specimen	Aging duration, hr	Compressive strength, MPa	Standard deviation	Coefficient of variation	Compression modulus, GPa	Standard deviation	Coefficient of variation	Strain at failure	Standard deviation	Coefficient of variation
T-3	100	656.61	24.37	3.70	67.85	2.41	3.60	1.10	0.10	9.10
	240	481.34	11.89	2.50	69.09	2.07	3.00	.80	.10	12.50
	500	363.50	22.22	6.10	65.50	5.52	.80	.60	.06	10.00
	1 510	140.24	8.18	5.80	59.92	1.38	2.30	.20	0	0
T-5	100	683.98	13.18	1.90	67.64	0.83	1.20	1.20	0	0
	240	606.28	26.47	4.40	69.23	3.17	4.60	1.30	.15	11.50
	500	578.84	21.27	3.70	66.26	2.00	3.00	1.30	.06	4.60
	1 000	481.13	16.43	3.40	57.92	2.14	3.70	1.20	.06	5.00
	1 730	316.76	29.90	9.40	47.02	1.17	2.50	.90	.10	11.10
T-12	240	694.40	34.53	5.00	66.47	3.65	5.50	1.30	0.20	15.40
	500	638.96	26.89	4.20	62.06	1.17	1.90	1.30	.06	4.60
	2 090	462.86	20.81	4.50	51.30	1.93	3.80	1.20	.10	8.30
T-50	100	581.94	25.10	4.30	69.09	1.03	1.50	-----	-----	-----
	240	548.15	28.47	5.20	69.64	4.83	6.90	-----	-----	-----
	1 730	84.05	10.45	12.40	58.95	2.76	4.70	-----	-----	-----

(f) Aging temperature, 343 °C

T-5	100	570.77	25.00	3.00	67.88	2.00	3.00	1.30	0.06	4.60
	240	602.97	32.37	3.70	64.47	2.07	3.20	1.40	0.06	4.30
	500	325.79	11.07	3.40	69.54	3.52	6.90	1.00	.10	10.00
T-50	670	84.19	3.76	4.50	58.95	5.65	10.30	-----	-----	-----

TABLE IX.—AVERAGE COMPRESSION STRENGTH AND WEIGHT LOSS OF T-650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(a) T-3 specimen

Aging duration, hr	Aging temperature, °C							
	204		260		288		316	
	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa
0	0	578.86	0	578.86	0	578.86	0	578.86
24	0.01		0.05		0.07		0.26	
48	.00		.03		.11		.34	
100	.01		.08		.17		.60	656.61
240	.04		.20		.30		1.10	481.34
360	-----		-----		-----		-----	
430	-----		-----		-----		-----	
500	.03		.30		.40		1.98	363.50
670	.03		.35		.48		2.90	
860	-----		-----		-----		4.05	
1 000	.03		.40		.65	649.78	5.08	
1 180	-----		-----		-----		5.91	
1 370	-----		-----		.72		8.17	
1 440	-----		-----		-----		8.94	
1 510	-----		-----		-----		9.54	140.24
1 680	-----		-----		.87		-----	
1 730	-----		-----		-----		-----	
2 000	.05		.60	679.78	.96	491.96	-----	
2 090	-----		-----		-----		-----	
2 600	.13		.71		1.30		-----	
2 950	-----		-----		1.54		-----	
3 120	-----		-----		1.65		-----	
3 420	-----		-----		1.93		-----	
3 740	.13		.99		2.23		-----	
5 000	.19	427.35	1.68		4.75		-----	
6 400			2.76		-----		-----	
7 200	.31		3.43		-----		-----	
10 000	.54		6.67		-----		-----	
11 350	.68		8.08		-----		-----	
12 330	.84		9.59	212.57	-----		-----	
13 460	1.03		-----		-----		-----	
14 680	1.22		-----		-----		-----	
15 830	1.49	190.10	-----		-----		-----	
17 720	1.70	142.73	-----		-----		-----	
20 000	2.16		-----		-----		-----	
22 590	2.48		-----		-----		-----	
26 300	3.48		-----		-----		-----	

TABLE IX.—Continued. AVERAGE COMPRESSION STRENGTH AND WEIGHT LOSS OF T-650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(b) T-5 specimen

Aging duration, hr	Aging temperature, °C									
	204		260		288		316		343	
	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa
0	0	697.48	0	697.48	0	697.48	0	697.48	0	697.48
24	0.02		0.02		0.05		0.21		0.50	
48	.01		.03		.06		.32		.67	
100	.02		.05		.13	709.63	.44	683.98	.93	570.77
240	.00		.08		.21		.72	606.28	2.05	602.97
360	-----		-----		-----		-----		3.84	
430	-----		-----		-----		-----		5.41	
500	.02		.20	725.63	.27		1.21	578.84	6.97	325.79
670	.01		.20		.32		1.81		11.11	
860	-----		-----		-----		2.64		-----	
1 000	.01	687.50	.25	724.04	.49	668.95	3.35	481.13	-----	
1 180	-----		-----		-----		4.13		-----	
1 370	-----		-----		.60		5.32		-----	
1 440	-----		-----		-----		5.89		-----	
1 510	-----		-----		-----		6.55		-----	
1 680	-----		-----		.69		-----		-----	
1 730	-----		-----		-----		9.27	316.76	-----	
2 000	.03	675.23	.45	702.88	.81	651.58	-----		-----	
2 090	-----		-----		-----		-----		-----	
2 600	.04		.60		1.06		-----		-----	
2 950	-----		-----		1.24		-----		-----	
3 120	-----		-----		1.34		-----		-----	
3 420	-----		-----		1.51		-----		-----	
3 740	.07		.89		1.79		-----		-----	
5 000	.08	616.55	1.23	625.10	3.35	464.79	-----		-----	
6 400	-----		1.83		-----		-----		-----	
7 200	.20		2.25		-----		-----		-----	
10 000	.40		3.82		-----		-----		-----	
11 350	.51		4.75		-----		-----		-----	
12 330	.54		5.73		-----		-----		-----	
13 460	.72	332.41	6.84	350.90	-----		-----		-----	
14 680	.87		8.05		-----		-----		-----	
15 830	.95		9.40		-----		-----		-----	
17 720	1.09		11.36	233.53	-----		-----		-----	
20 000	1.28		13.69		-----		-----		-----	
22 590	1.53		-----		-----		-----		-----	
26 300	2.44		-----		-----		-----		-----	

TABLE IX.—Continued. AVERAGE COMPRESSION STRENGTH AND WEIGHT LOSS OF T-650-35/PMR-15  
AFTER AGING AT VARIOUS TEMPERATURES

(c) T-12 specimen

Aging duration, hr	204		260		288		316	
	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa
0	0	667.39	0	667.39	0	667.39	0	667.39
24	0.03		0.05		0.06		0.26	
48	.03		.06		.09		.37	
100	.04		.09		.12		.44	
240	.04		.10		.18		.70	694.40
360	-----		-----		-----		-----	
430	-----		-----		-----		-----	
500	.04		.13		.25		1.02	638.96
670	.04		.16		.29		1.22	
860	-----		-----		-----		1.47	
1 000	.04		.20		.35	667.09	1.69	
1 180	-----		-----		-----		2.19	
1 370	-----		-----		.45		3.01	
1 440	-----		-----		-----		3.40	
1 510	-----		-----		-----		3.69	
1 680	-----		-----		.52		-----	
1 730	-----		-----		-----		5.23	
2 000	.06		.35		.61	673.71	-----	
2 090	-----		-----		-----		8.05	462.86
2 600	.07		.45		.83		-----	
2 950	-----		-----		.95		-----	
3 120	-----		-----		1.02		-----	
3 420	-----		-----		1.17		-----	
3 740	.09		.71		1.40		-----	
5 000	.10	720.18	.95	672.68	2.13		-----	
6 400	-----		1.34		-----		-----	
7 200	.12		1.74		-----		-----	
10 000	.19		2.91		-----		-----	
11 350	.25		3.40		-----		-----	
12 330	.32		4.04		-----		-----	
13 460	.36	580.28	4.95		-----		-----	
14 680	.44		6.20		-----		-----	
15 830	.54	477.62	6.93	161.89	-----		-----	
17 720	.67	521.26	8.50	421.70	-----		-----	
20 000	.85		10.92		-----		-----	
22 590	1.13		-----		-----		-----	
26 300	1.73		-----		-----		-----	

TABLE IX.—Concluded. AVERAGE COMPRESSION STRENGTH AND WEIGHT LOSS OF T-650-35/PMR-15  
AFTER AGING AT VARIOUS TEMPERATURES

(d) T-50 specimen

Aging duration, hr	Aging temperature, °C							
	260		288		316		343	
	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa	Weight loss, percent	Strength, MPa
0	0	610.69	0	610.69	0	610.69	0	610.69
24	0.04		0.06		0.16		0.42	
48	.07		.09		.25		.63	
100	.09		.13		.38	581.94	.93	
240	.11		.16		.65	548.15	1.97	
360							3.54	
430							4.80	
500	.15		.27		1.40		6.19	
670	.20		.35		1.93		10.09	84.19
860					2.82			
1 000	.27		.47	522.99	3.55			
1 180					4.66			
1 370			.73		6.29			
1 440					6.91			
1 510					7.53			
1 680			.96					
1 730					9.75	84.05		
2 000	.48	49.77	1.17	433.70				
2 090								
2 600	.63		1.71					
2 950			2.10					
3 120			2.32					
3 420			2.73					
3 740	1.09		3.27					
5 000	2.01	394.60	5.28	362.22				
6 400	3.24							
7 200	3.96							

TABLE X.—AVERAGE COMPRESSION MODULUS AND WEIGHT LOSS OF T-650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(a) T-3 specimen

Aging duration, hr	Aging temperature, °C								
	204		260		288		316		343
	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent
0	0	73.29	0	73.29	0	73.29	0	73.29	0
24	0.01								
48	.00								
100	.01		0.08		0.17		0.60	67.85	0.62
240	.04		.20		.30		1.10	69.09	2.73
360									
430									7.83
500	.03		.30		.40		1.98	65.50	10.77
670							4.05		
860									
1 000	.03		.40		.65	67.43	5.08		
1 180							5.91		
1 370					.72		8.17		
1 440							8.94		
1 510							9.54	59.92	
1 680					.87				
1 730									
2 000	.05		.60	71.85	.96	75.43			
2 090									
2 600	.13		.71		1.30				
2 950					1.54				
3 120					1.65				
3 420					1.93				
3 740	.13		.99		2.23				
5 000	.19	70.95	1.68		4.75				
6 400			2.76						
7 200	.31		3.43						
10 000	.54		6.67						
11 350	.68		8.08						
12 330	.84		9.59	59.37					
13 460	1.03								
14 680	1.22								
15 830	1.49	64.88							
17 720	1.70	70.88							
20 000	2.16								
22 590	2.48								
26 300	3.48								

TABLE X.—Continued. AVERAGE COMPRESSION MODULUS AND WEIGHT LOSS OF T-650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(b) T-5 specimen

Aging duration, hr	Aging temperature, °C									
	204		260		288		316		343	
	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa
0	0	66.90	0	66.90	0	66.90	0	66.90	0	66.90
24	----		0.02		0.05		0.21		0.50	
48	0	66.90	.03		.06		.32		.67	
100	0.02		.05		.13	64.47	.44	67.64	.93	67.09
240	.00		.08		.21		.72	10.04	2.05	64.47
360					----				3.84	
430					----				5.41	
500	.02		.20	64.54	.27		1.21	66.26	6.97	51.02
670	.01		.20		.32		1.81		11.11	
860	----		----		----		2.64		----	
1000	.01	66.61	.25	65.78	.49	65.09	3.35	57.92	----	
1 180	----		----		----		4.13		----	
1 370	----		----		.60		5.32		----	
1 440	----		----		----		5.89		----	
1 510	----		----		----		6.55		----	
1 680	----		----		.69		----		----	
1 730	----		----		----		9.27	47.02	----	
2 000	.03	66.69	.45	66.90	.81	66.35	----		----	
2 090	----		----		----		----		----	
2 600	.04		.60		1.06		----		----	
2 950	----		----		1.24		----		----	
3 120	----		----		1.34		----		----	
3 420	----		----		1.51		----		----	
3 740	.07		.89		1.79		----		----	
5 000	.08	65.30	1.23	68.47	3.35	53.44	----		----	
6 400	----		1.83		----		----		----	
7 200	.20		2.25		----		----		----	
10 000	.40		3.82		----		----		----	
11 350	.51		4.75		----		----		----	
12 330	.54		5.73		----		----		----	
13 460	.72	49.18	6.84	50.75	----		----		----	
14 680	.87		8.05		----		----		----	
15 830	.95		9.40		----		----		----	
17 720	1.09		11.36	45.99	----		----		----	
20 000	1.28		13.69		----		----		----	
22 590	1.53		----		----		----		----	
26 300	2.44		----		----		----		----	

TABLE X.—Continued. AVERAGE COMPRESSION MODULUS AND WEIGHT LOSS OF T-650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(c) T-12 specimen

Aging duration, hr	Aging temperature, °C								
	204		260		288		316		343
	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent
0	0	64.97	0	64.97	0	64.97	0	64.97	0
24	0.03		0.05		0.06		0.26		0.63
48	.03		.06		.09		.37		.82
100	.04		.09		.12		.44		1.02
240	.04		.10		.18		.70	66.47	1.74
360	-----		-----		-----		-----		2.94
430	-----		-----		-----		-----		3.90
500	.04		.13		.25		1.02	62.06	4.98
670	.04		.16		.29		1.22		8.59
860	-----		-----		-----		1.47		-----
1 000	.04		.20		.35	66.74	1.69		-----
1 180	-----		-----		-----		2.19		-----
1 370	-----		-----		.45		3.01		-----
1 440	-----		-----		-----		3.40		-----
1 510	-----		-----		-----		3.69		-----
1 680	-----		-----		.52		-----		-----
1 730	-----		-----		-----		5.23		-----
2 000	.06		.35		.61	66.81	-----		-----
2 090	-----		-----		-----		8.05	51.30	-----
2 600	.07		.45		.83		-----		-----
2 950	-----		-----		.95		-----		-----
3 120	-----		-----		1.02		-----		-----
3 420	-----		-----		1.17		-----		-----
3 740	.09		.71		1.40		-----		-----
5 000	.10	68.40	.95	67.78	2.13		-----		-----
6 400	-----		1.34		-----		-----		-----
7 200	.12		1.74		-----		-----		-----
10 000	.19		2.91		-----		-----		-----
11 350	.25		3.40		-----		-----		-----
12 330	.32		4.04		-----		-----		-----
13 460	.36	62.19	4.95		-----		-----		-----
14 680	.44		6.20		-----		-----		-----
15 830	.54	58.75	6.93	63.23	-----		-----		-----
17 720	.67	55.85	8.50	58.61	-----		-----		-----
20 000	.85		10.92		-----		-----		-----
22 590	1.13		-----		-----		-----		-----
26 300	1.73		-----		-----		-----		-----



TABLE X.—Concluded. COMPRESSION MODULUS AND WEIGHT LOSS OF T-650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(d) T-50 specimen

Aging duration, hr	Aging temperature, °C							
	260		288		316		343	
	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa	Weight loss, percent	Modulus, GPa
0	0	69.85	0	69.85	0	69.85	0	69.85
24	0.04		0.06		0.16		0.42	
48	.07		.09		.25		.63	
100	.09		.13		.38	69.09	.93	
240	.11		.16		.65	69.64	1.97	
360	----		----		----		3.54	
430	----		----		----		4.80	
500	.15		.27		1.40		6.19	
670	.20		.35		1.93		10.09	54.75
860	----		----		2.82		----	
1 000	.27		.47	69.98	3.55		----	
1 180	----		----		4.66		----	
1 370	----		.73		6.29		----	
1 440	----		----		6.91		----	
1 510	----		----		7.53		----	
1 680	----		.96		----		----	
1 730	----		----		9.75	58.95	----	
2 000	.48	69.64	1.17	69.98	----		----	
2 090	----		----		----		----	
2 600	.63		1.71		----		----	
2 950	----		2.10		----		----	
3 120	----		2.32		----		----	
3 420	----		2.73		----		----	
3 740	1.09		3.27		----		----	
5 000	2.01	68.61	5.28	63.85	----		----	
6 400	3.24		----		----		----	
7 200	3.96		----		----		----	
10 000	6.22		----		----		----	

TABLE XI.—AVERAGE VALUES OF COMPRESSION STRENGTH AND MODULUS OF T650-35/PMR-15  
AFTER AGING AT VARIOUS TEMPERATURES

(a) T-3 specimen

Aging duration, hr	Aging temperature, °C							
	204		260		288		316	
	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa
0	578.86	73.29	578.86	73.29	578.86	73.29	578.86	73.29
24								
48								
100	-----	-----	-----	-----	-----	-----	656.61	67.85
240	-----	-----	-----	-----	-----	-----	485.18	69.09
360								
430								
500	-----	-----	-----	-----	-----	-----	363.50	65.50
670								
860								
1 000	-----	-----	-----	-----	649.78	67.43	-----	-----
1 180								
1 370								
1 440								
1 510	-----	-----	-----	-----	-----	-----	140.24	8.69
1 680								
1 730								
2 000	-----	-----	679.78	71.85	491.96	75.43	-----	-----
2 090								
2 600								
2 950								
3 120								
3 420								
3 740								
5 000	427.35	70.95	-----	-----	-----	-----	-----	-----
6 400								
7 200								
10 000								
11 350								
12 330	-----	-----	212.57	59.37	-----	-----	-----	-----
13 460								
14 680								
15 830	190.10	64.81	-----	-----	-----	-----	-----	-----
17 720	142.73	70.88	-----	-----	-----	-----	-----	-----

TABLE XI.—Continued. AVERAGE VALUES OF COMPRESSION STRENGTH AND MODULUS OF T650-35/PMR-15  
AFTER AGING AT VARIOUS TEMPERATURES

(b) T-5 specimen

Aging duration, hr	Aging temperature, °C									
	204		260		288		316		343	
	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa
0	697.48	66.90	697.48	66.90	697.48	66.90	697.48	66.90	697.48	66.90
24										
48										
100	-----	-----	-----	-----	709.01	64.47	683.98	67.64	570.77	67.09
240	-----	-----	-----	-----	-----	-----	606.28	69.23	602.97	64.47
360										
430										
500	-----	-----	725.63	64.54	-----	-----	578.84	66.26	325.79	63.43
670										
860										
1 000	687.50	66.61	724.04	65.78	668.95	65.09	481.13	57.92	-----	-----
1 180										
1 370										
1 440										
1 510										
1 680										
1 730	-----	-----	-----	-----	-----	-----	316.76	47.02	-----	-----
2 000	675.23	66.67	702.88	66.19	651.58	66.33	-----	-----	-----	-----
2 090										
2 600										
2 950										
3 120										
3 420										
3 740										
5 000	616.55	65.30	625.10	68.47	464.79	53.44	-----	-----	-----	-----
6 400										
7 200										
10 000										
11 350										
12 330										
13 460	332.41	49.16	314.62	50.75	-----	-----	-----	-----	-----	-----
14 680										
15 830										
17 720	-----	-----	233.53	45.99	-----	-----	-----	-----	-----	-----

TABLE XI.—Continued. AVERAGE VALUES OF COMPRESSION STRENGTH AND MODULUS OF T650–35/PMR–15 AFTER AGING AT VARIOUS TEMPERATURES

(c) T–12 specimen

Aging duration, hr	Aging temperature, °C						
	204		260		288		316
	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa
0	667.39	64.97	667.39	64.97	667.39	64.97	667.39
24							
48							
100							
240	-----	-----	-----	-----	-----	-----	694.40
360							
430							
500	-----	-----	-----	-----	-----	-----	638.96
670							
860							
1 000	-----	-----	-----	-----	667.09	66.74	-----
1 180							
1 370							
1 440							
1 510							
1 680							
1 730							
2 000	-----	-----	-----	-----	673.71	66.81	-----
2 090	-----	-----	-----	-----	-----	-----	462.86
2 600							
2 950							
3 120							
3 420							
3 740							
5 000	720.18	68.40	672.68	67.78	-----	-----	-----
6 400							
7 200							
10 000							
11 350							
12 330							
13 460	580.28	62.19	-----	-----	-----	-----	-----
14 680							
15 830	477.62	58.75	161.89	63.23	-----	-----	-----
17 720	521.26	55.85	421.70	58.61	-----	-----	-----

TABLE XI.—Concluded. AVERAGE VALUES OF COMPRESSION STRENGTH AND MODULUS OF T-650-35/PMR-15 AFTER AGING AT VARIOUS TEMPERATURES

(d) T-50 specimen

Aging duration, hr	Aging temperature, °C				
	260		288		316
	Strength, MPa	Modulus, GPa	Strength, MPa	Modulus, GPa	Strength, MPa
0	610.69	69.85	610.69	69.85	610.69
24					
48					
100	-----	-----	581.94	69.70	-----
240	-----	-----	548.15	69.64	-----
360					
430					
500					
670	-----	-----	-----	-----	84.19
860					
1 000	522.99	69.98	-----	-----	-----
1 180					
1 370					
1 440					
1 510					
1 680					
1 730	-----	-----	84.05	58.95	-----
2 000	433.70	69.98	-----	-----	-----
2 090					
2 600					
2 950					
3 120					
3 420					
3 740					
5 000	174.72	63.85	-----	-----	-----

TABLE XII.—SHRINKAGE OF T650-35/PMR-15  
SPECIMENS WITH AGING

Specimen	Aging temperature, °C	Aging duration, hr	Shrinkage, percent
T-3	204	15 830	3.70
	204	23 000	3.92
	260	12 330	4.00
	260	12 330	4.90
	288	7 936	3.06
T-5	204	23 000	2.48
	260	10 000	2.75
	260	14 345	3.70
	288	2 000	0
	288	8 960	6.42
	316	240	1.82
	↓	1 000	3.64
	↓	1 730	<sup>a</sup> 4.59
	↓	1 730	5.56
	↓	1 730	<sup>a</sup> 5.56
	↓	1 730	<sup>a</sup> 5.77
	343	500	<sup>a</sup> 3.67
T-12	204	5 000	0
	↓	13 460	0.37
	↓	15 830	.73
	↓	17 720	.73
	↓	23 000	1.27
	260	15 830	2.56
	260	17 720	3.27
	316	240	1.46
	316	2 090	2.19
	343	100	1.46
E	204	23 000	2.00
	316	100	0
T-50	204	5 000	0
	204	23 000	0.59
	204	23 000	.78
	288	5 000	.78
	316	1 730	<sup>a</sup> 1.46
	343	670	<sup>a</sup> 1.17
GP1	204	23 000	0.58

<sup>a</sup>Surface fibers were bare.

TABLE XIII.—SURFACE LAYER DAMAGE

[Where sections are blank,  
no data were obtained.]

Aging temperature, °C	Aging duration, hr	Specimen	Thickness of surface damage, m	Strength, fraction of unaged strength			
				T-3	T-5	T-12	T-50
204	0			1.00	1.00	1.00	
	1 000	T-50	$7.62 \times 10^{-5}$		.99		
	2 000	E	$4.83 \times 10^{-5}$		.97		
	5 000	T-50	$1.60 \times 10^{-4}$	.74	.88	1.08	
	5 000	E	$1.60 \times 10^{-4}$				
	14 680	T-12	$8.89 \times 10^{-4}$				
	15 830	T-50	$8.89 \times 10^{-4}$	.33		.72	
260	0			1.00	1.00	1.00	1.00
	1 000	T-50	$6.35 \times 10^{-5}$		1.04		
	2 000	T-50	$1.22 \times 10^{-4}$	1.17	1.01		.81
	3 000	E	$1.50 \times 10^{-4}$				
	10 000	T-50					.31
	12 330	T-3		.37			
	14 348	T-5	$3.81 \times 10^{-4}$				
20 000	G	$6.60 \times 10^{-4}$					
288	0			1.00	1.00	1.00	1.00
	500	E	$6.35 \times 10^{-5}$				
	500	T-50	0				
	1 000	T-50	$9.53 \times 10^{-5}$	1.12	.96	1.00	.86
2 000	T-50	$1.27 \times 10^{-4}$	.85	.93	1.01	.71	
316	0			1.00	1.00	1.00	1.00
	100	T-3	0	1.13	.98		.95
	100	T-12	0				
	500	T-12	$9.65 \times 10^{-5}$	.63	.83	.96	
	500	G	$9.91 \times 10^{-5}$				
	1 000	T-5	$4.78 \times 10^{-4}$		.69		
	1 730	T-5	$8.64 \times 10^{-4}$		.45		.14
343	240	T-50	$3.96 \times 10^{-4}$				
	500	T-50	$3.96 \times 10^{-4}$				
	500	T-3	$2.87 \times 10^{-4}$				

TABLE XIV.—GLASS TRANSITION TEMPERATURES FOR T-5 SPECIMENS AGED FOR VARIOUS TIMES AT DIFFERENT TEMPERATURES

Aging duration, hr	Ambient temperature	Aging temperature, °C			
		204	260	288	316
		Glass transition temperature, °C			
0	330	---	---	---	---
0	342	---	---	---	---
0	341	---	---	---	---
500	---	---	---	---	358
1 000	---	---	---	349	364
2 000	---	328	330	352	391
5 000	---	323	---	346	---
10 000	---	322	350	---	---

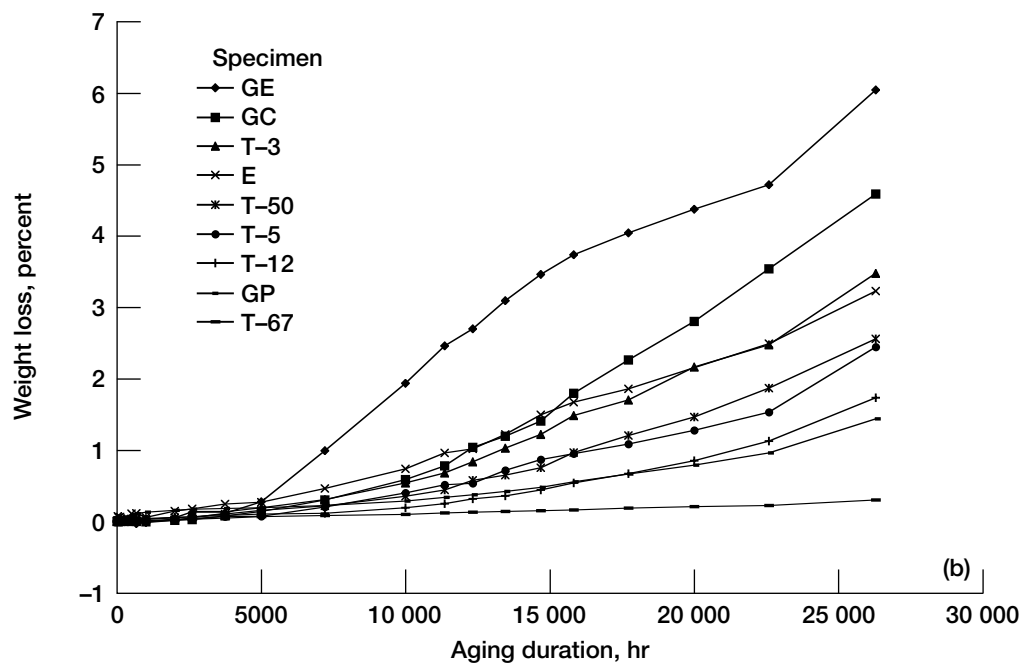
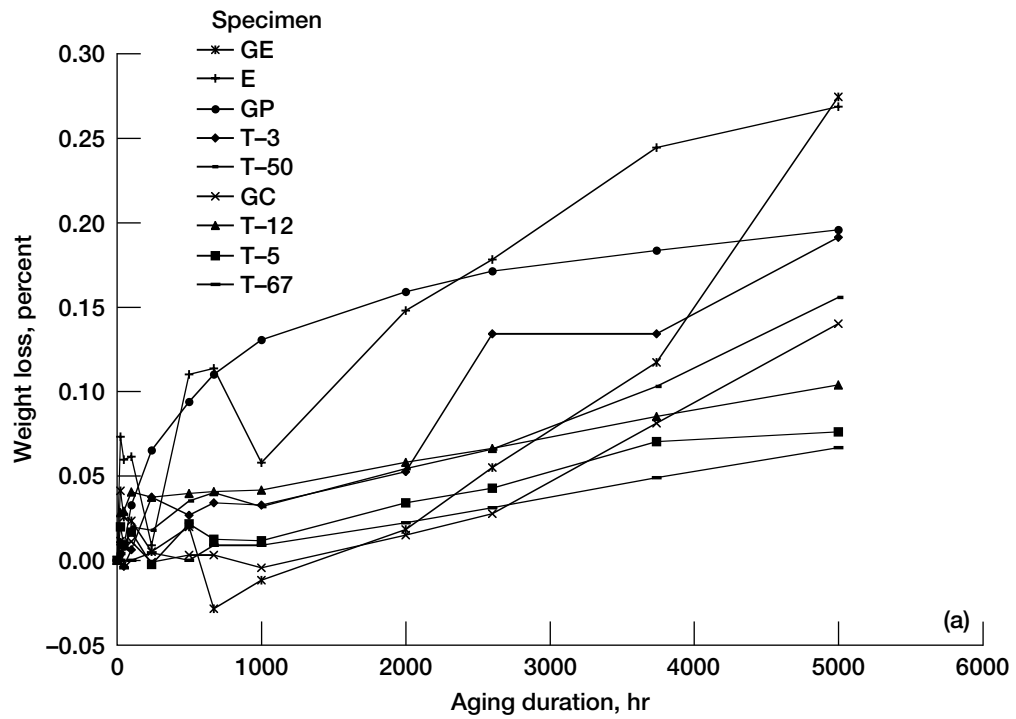


Figure 1.—Weight loss as function of aging at 204 °C for T-650-35/PMR-15 composites.  
 (a) Short aging times. (b) Long aging times.



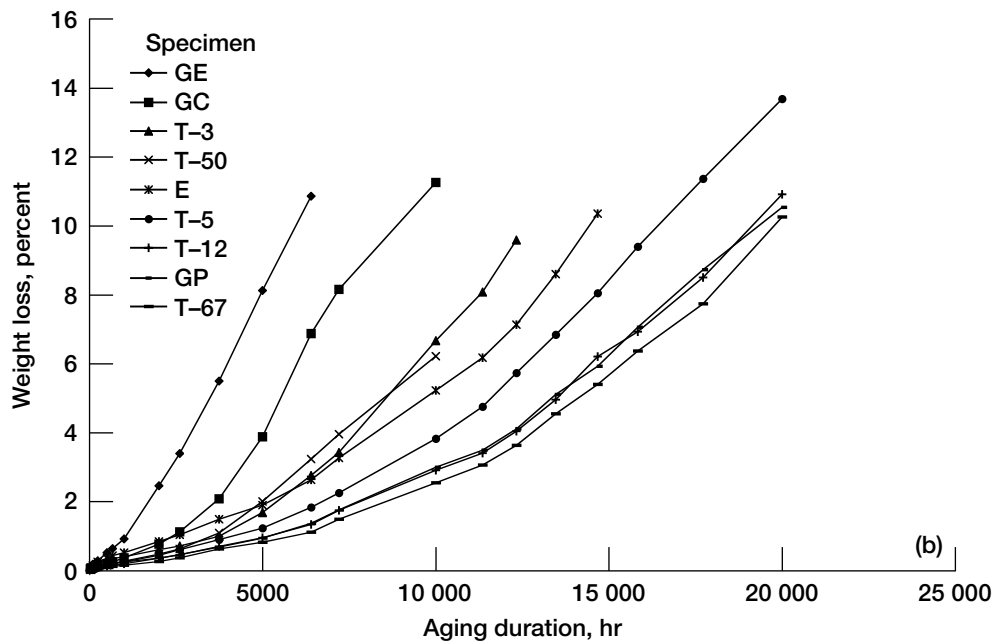
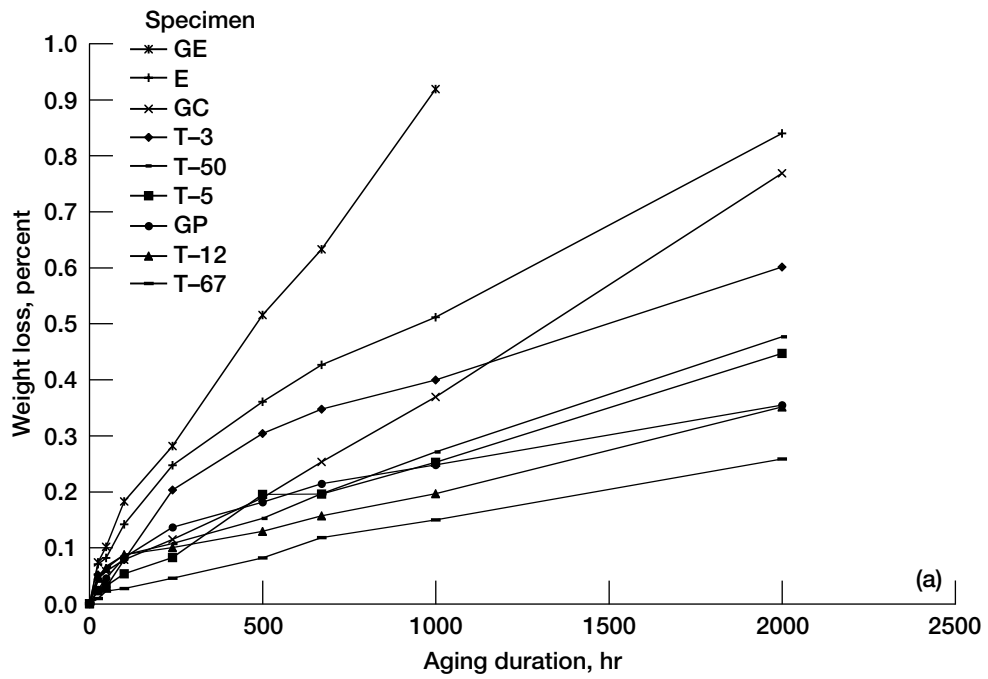


Figure 2.—Weight loss as function of aging at 260 °C for T-650-35/PMR-15 composites. (a) Short aging times. (b) Long aging times.

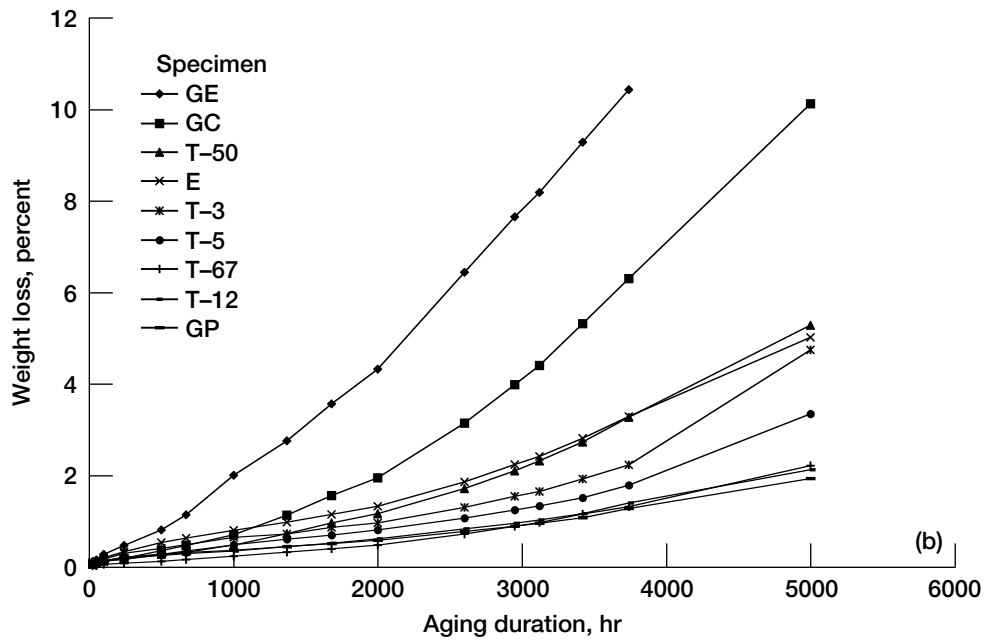
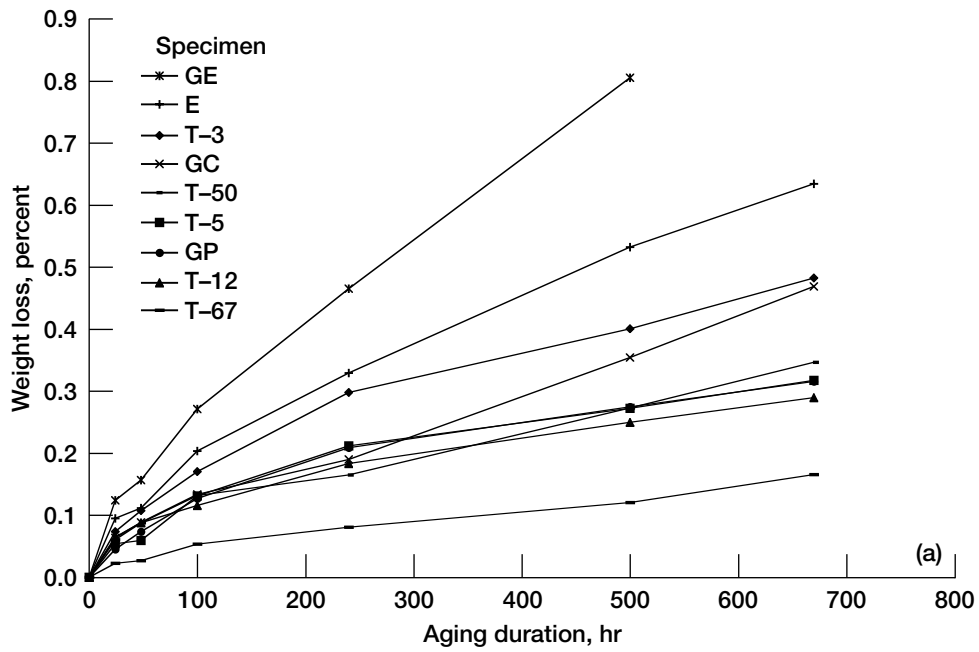


Figure 3.—Weight loss as function of aging at 288 °C for T-650-35/PMR-15 composites. (a) Short aging times. (b) Long aging times.

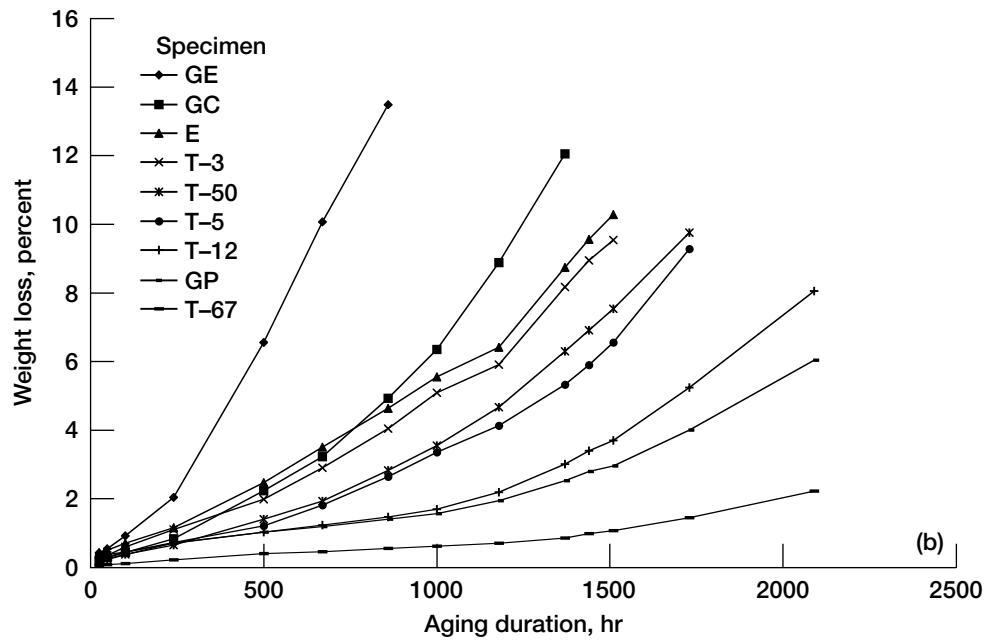
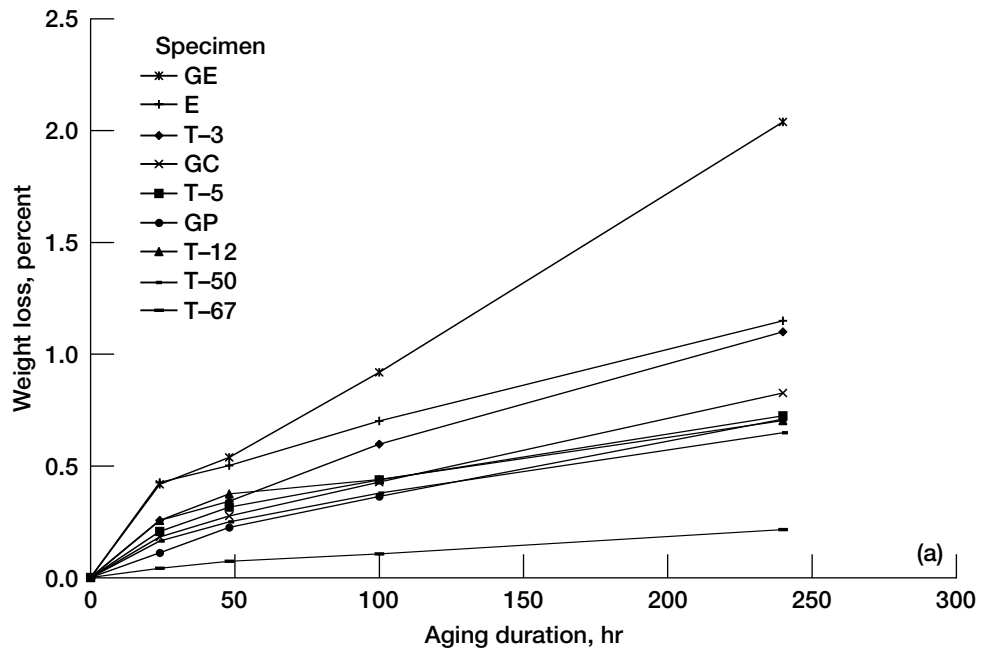


Figure 4.—Weight loss as function of aging at 316 °C for T-650-35/PMR-15 composites. (a) Short aging times. (b) Long aging times.

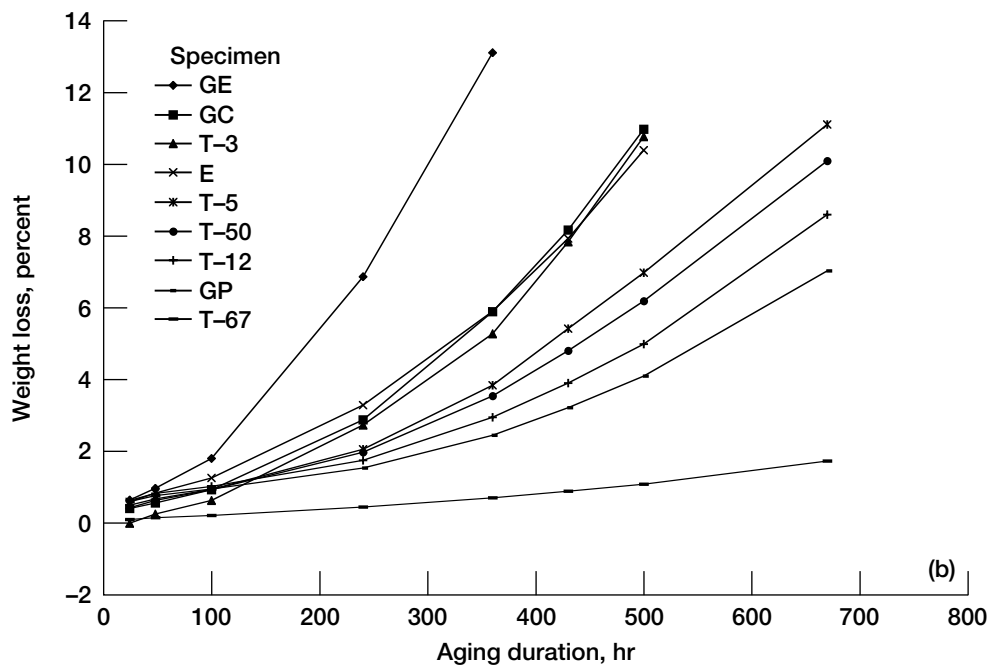
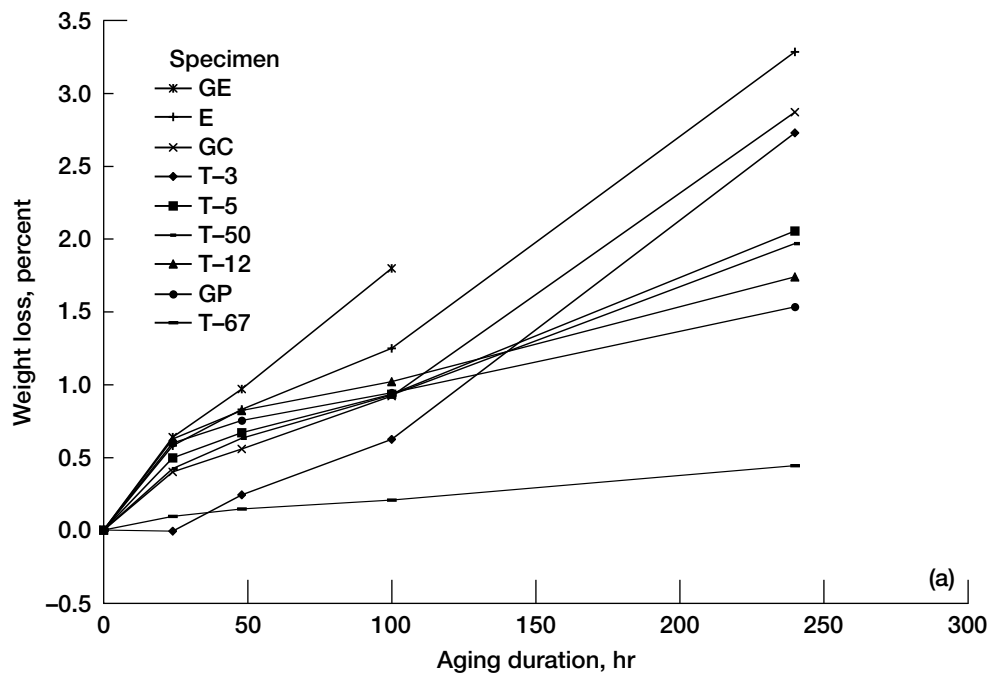


Figure 5.—Weight loss as function of aging at 343 °C for T-650-35/PMR-15 composites. (a) Short aging times. (b) Long aging times.

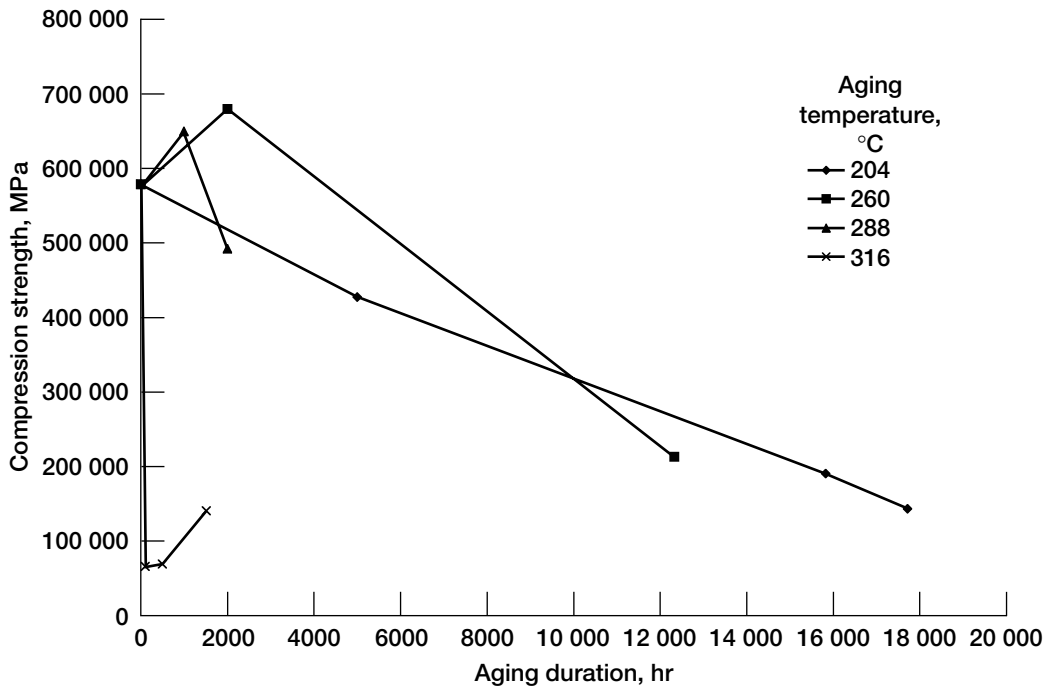


Figure 6.—Compression strength of T-3 specimens as function of aging.

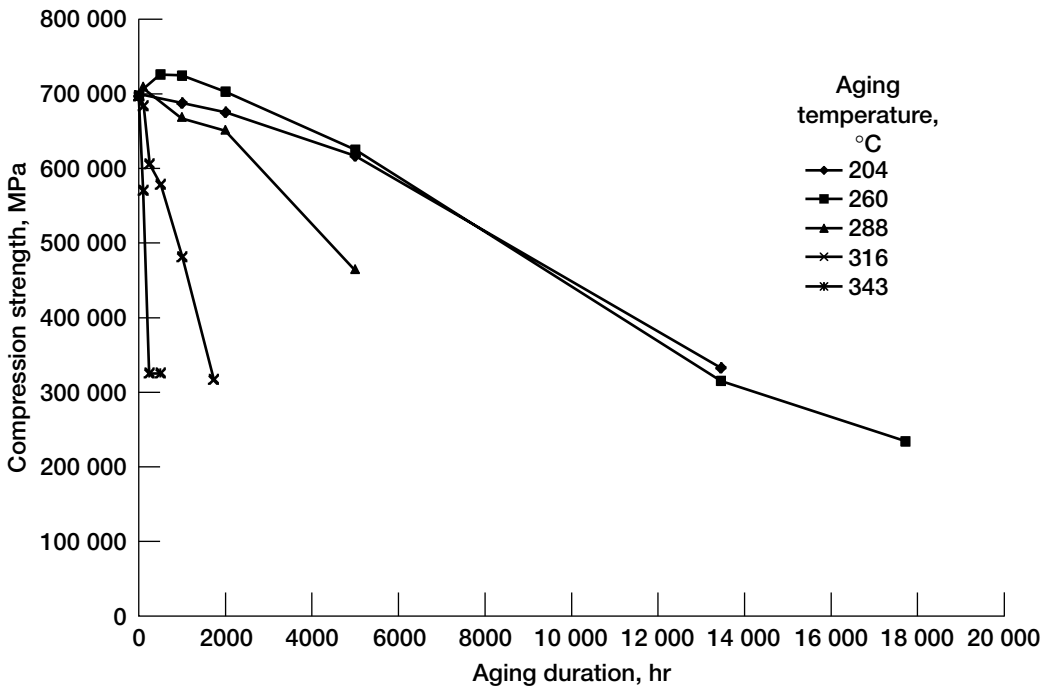


Figure 7.—Compression strength of T-5 specimens as function of aging.

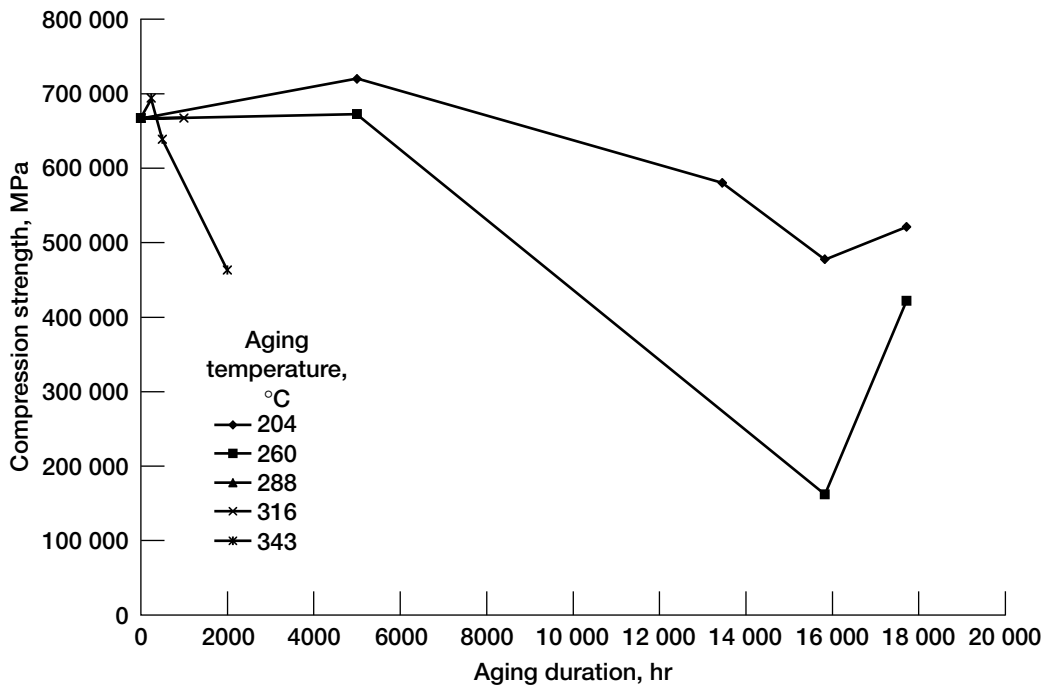


Figure 8.—Compression strength of T-12 specimens as function of aging.

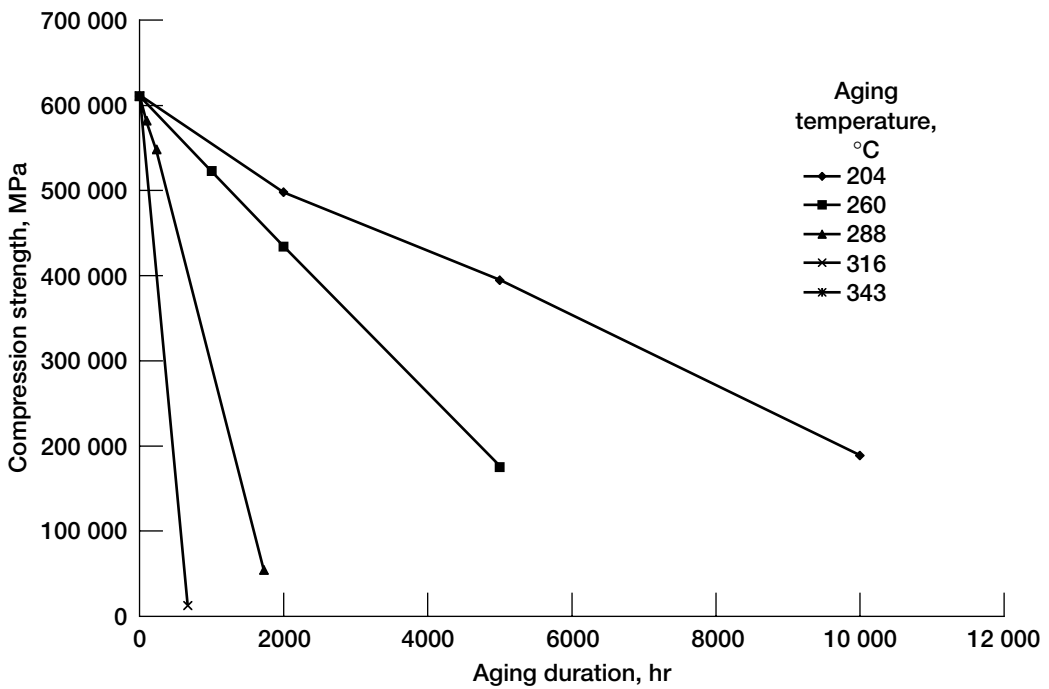


Figure 9.—Compression strength of T-50 specimens as function of aging.

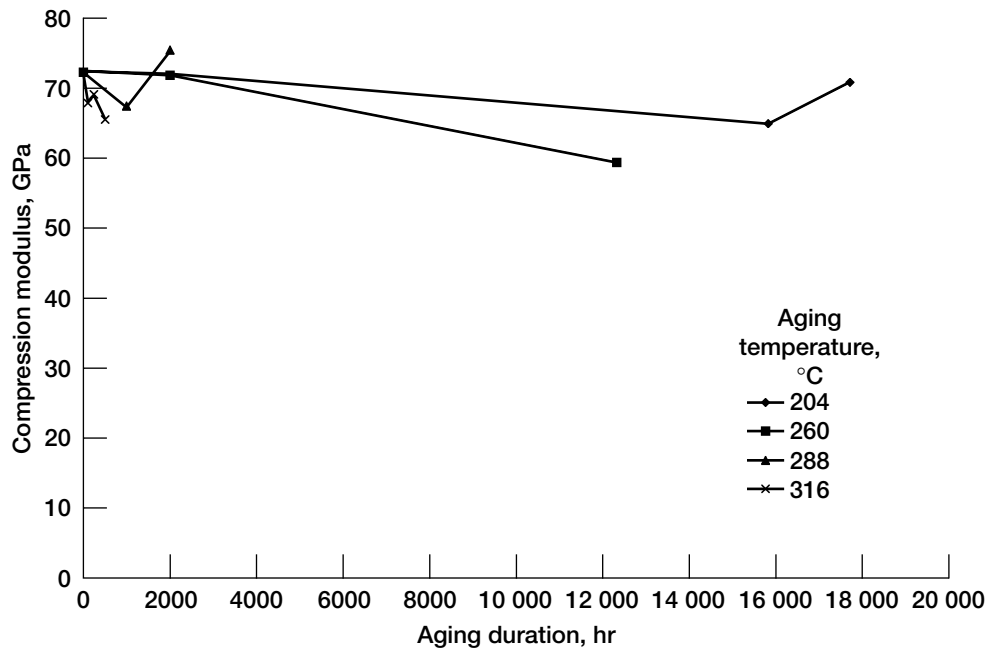


Figure 10.—Compression modulus of T-3 specimens as function of aging.

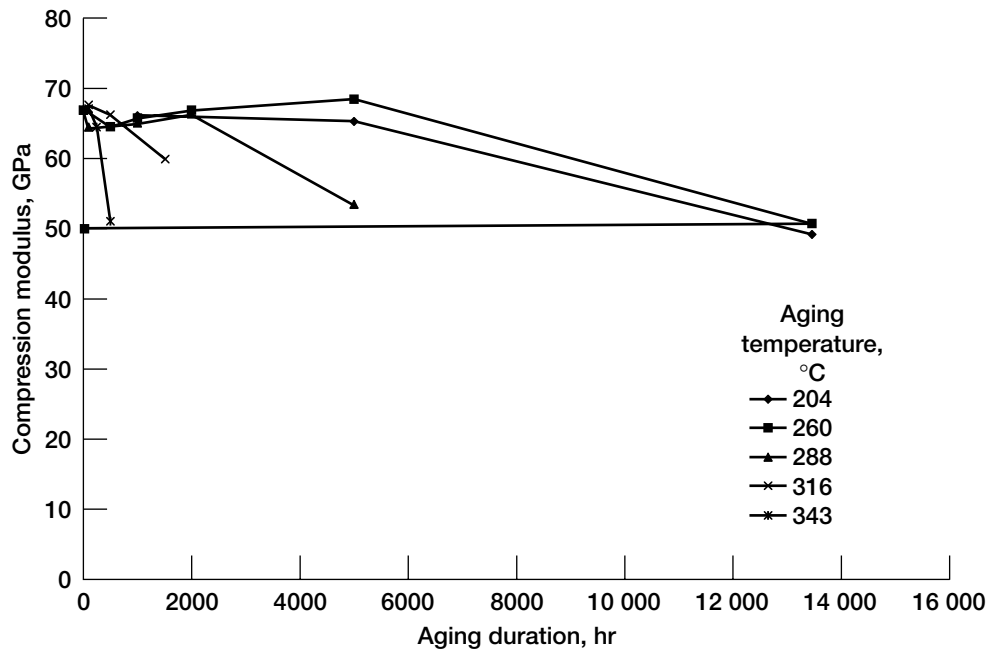


Figure 11.—Compression modulus of T-5 specimens as function of aging.

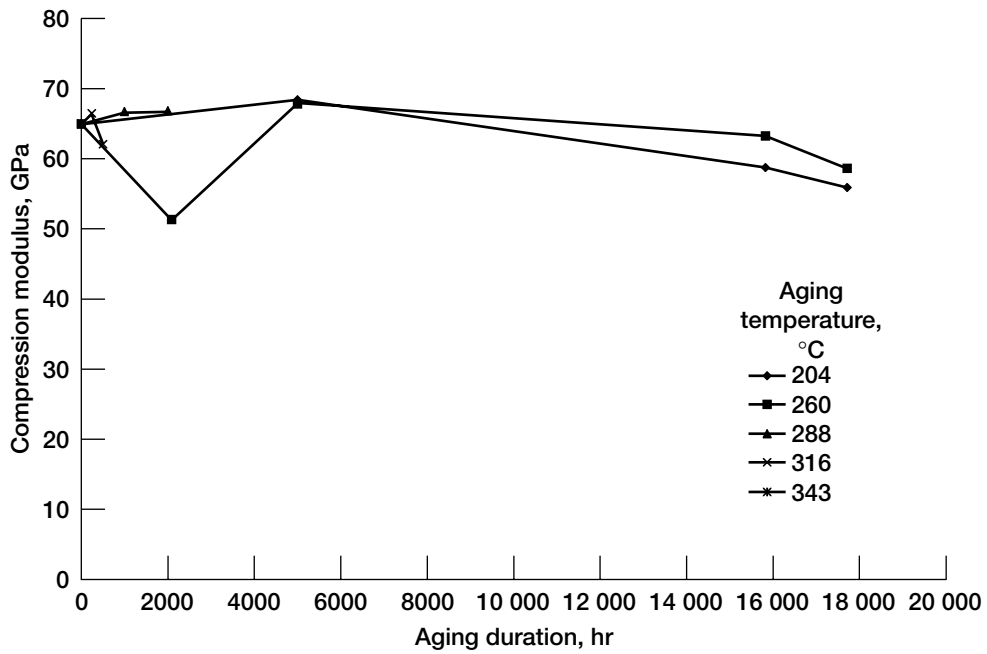


Figure 12.—Compression modulus of T-12 specimens as function of aging.

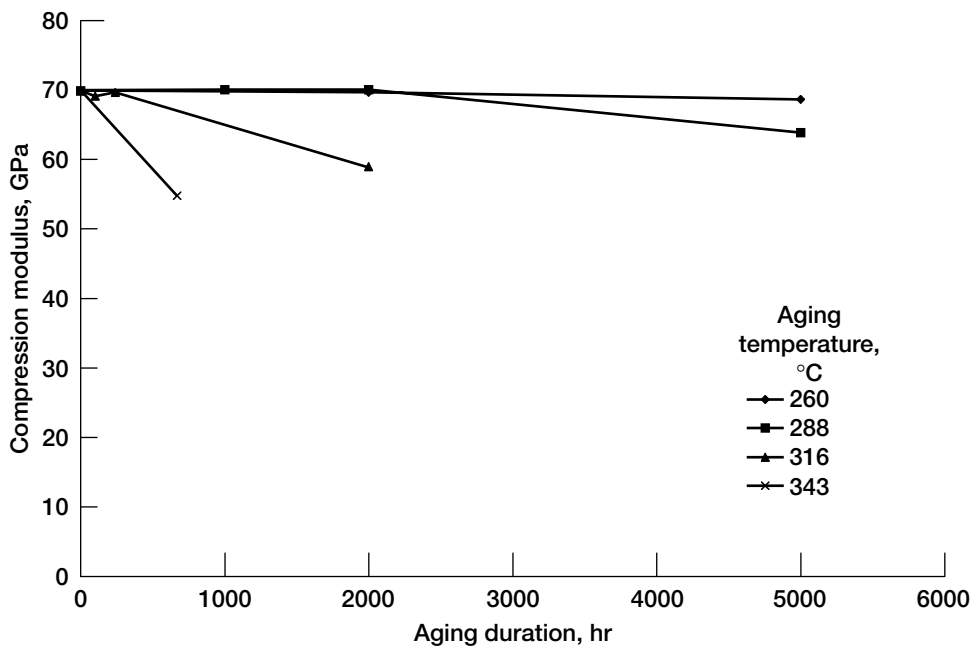


Figure 13.—Compression modulus of T-50 specimens as function of aging.



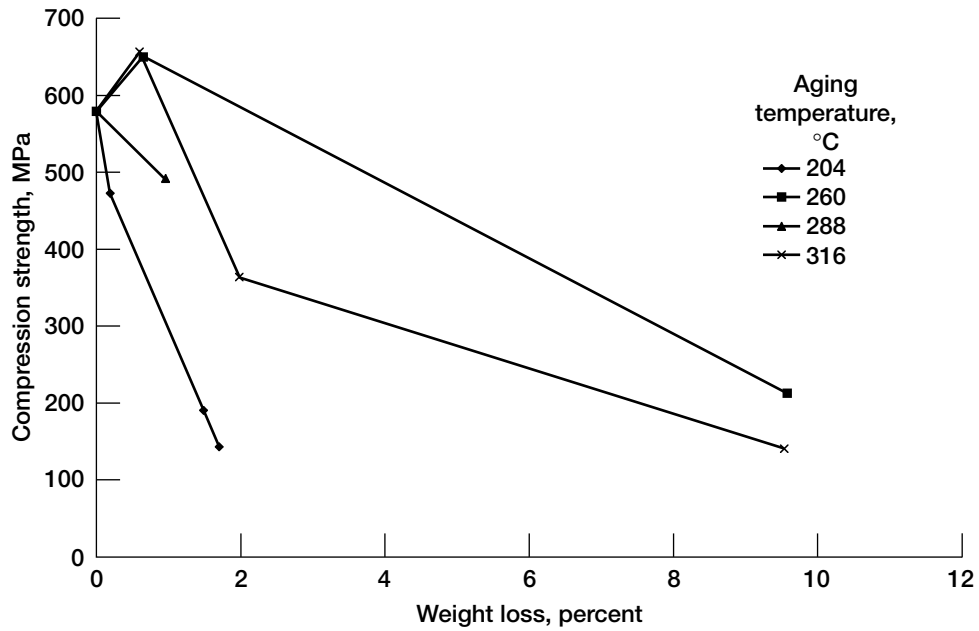


Figure 14.—Compression strength of T-3 specimens as function of weight loss after aging at various temperatures.

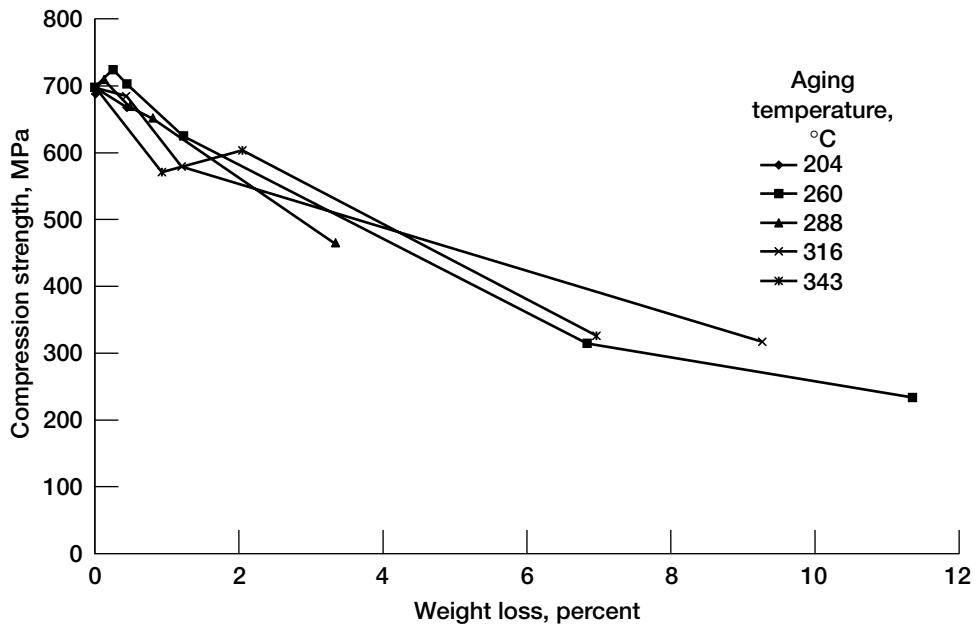


Figure 15.—Compression strength of T-5 specimens as function of weight loss after aging at various temperatures.

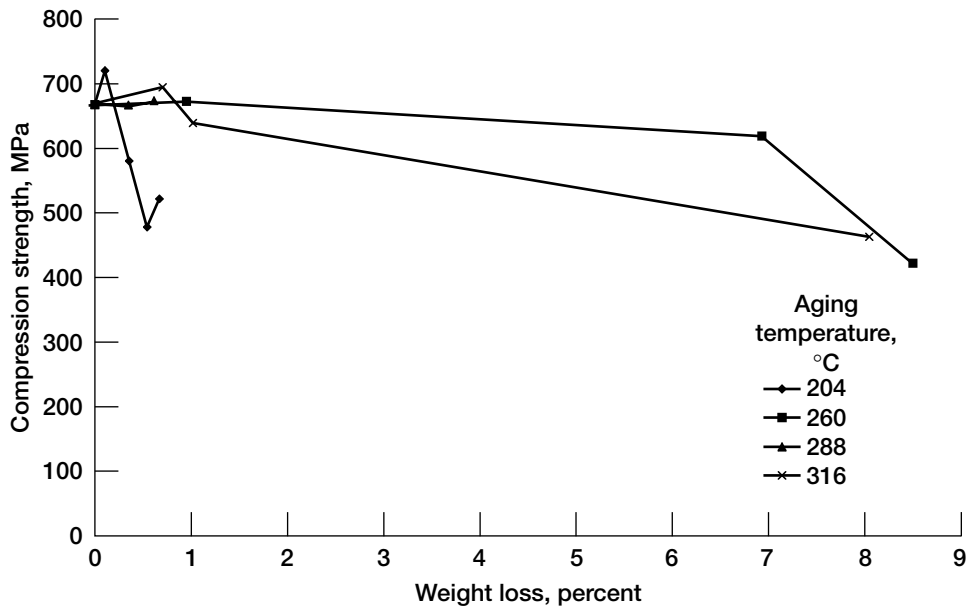


Figure 16.—Compression strength of T-12 specimens as function of weight loss after aging at various temperatures.

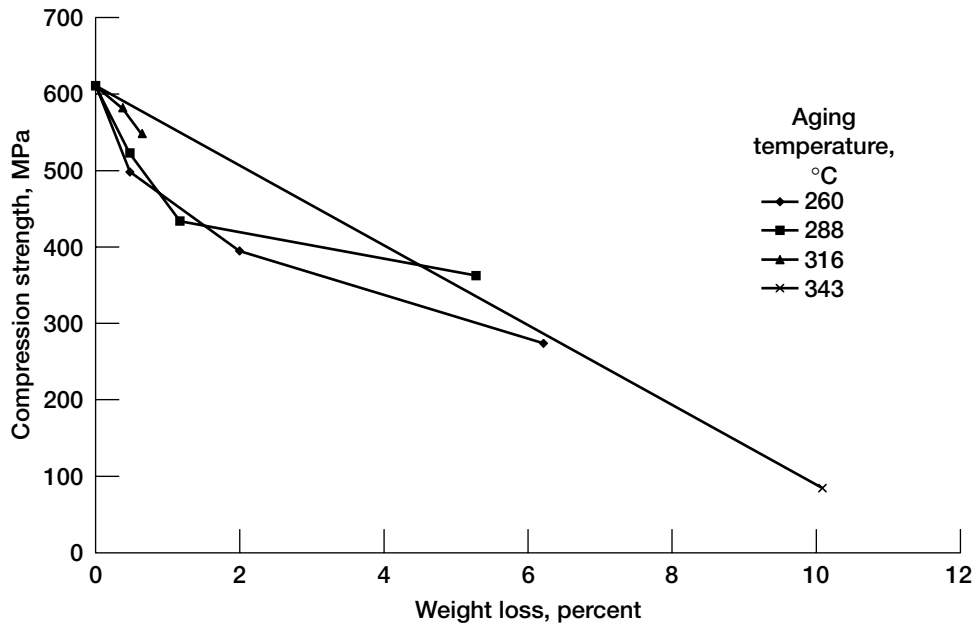


Figure 17.—Compression strength of T-50 specimens as function of weight loss after aging at various temperatures.

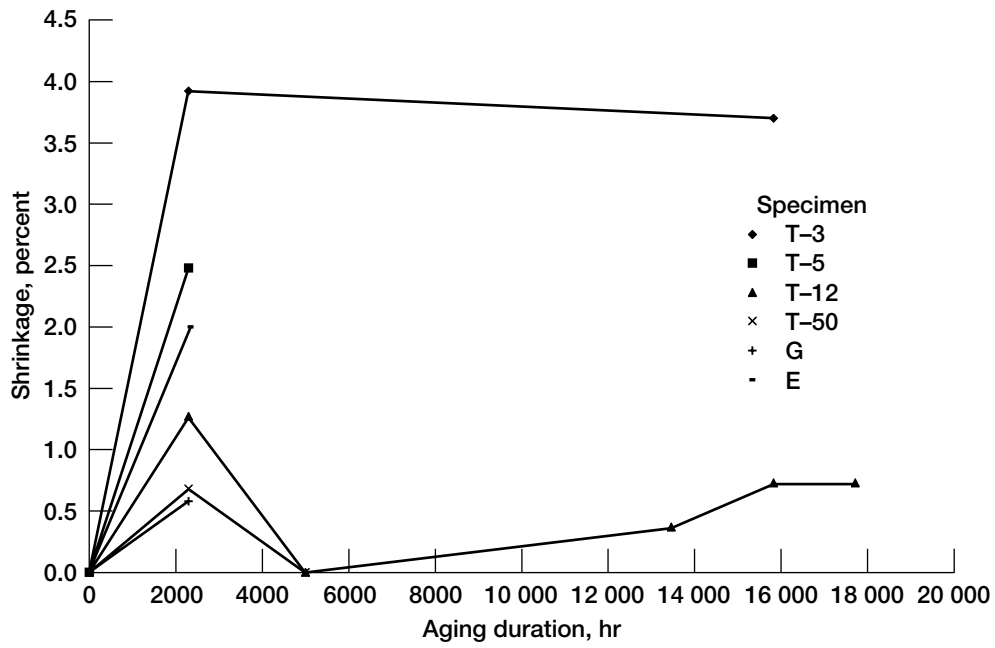


Figure 18.—Shrinkage of T-650-35/PMR-15 composite specimens with aging at 204 °C.

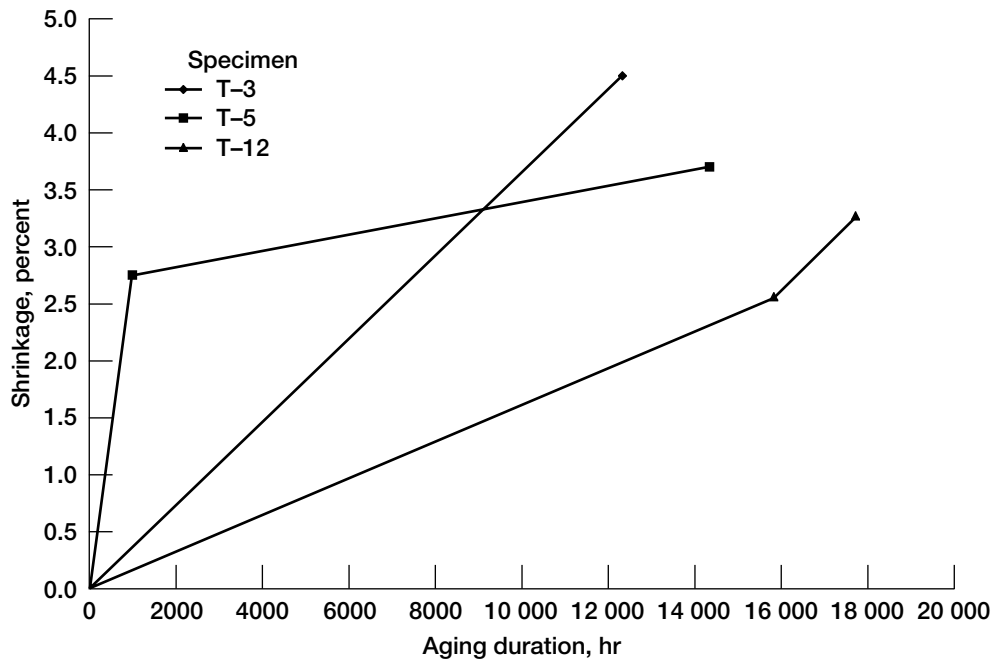


Figure 19.—Shrinkage of T-650-35/PMR-15 composite specimens with aging at 260 °C.

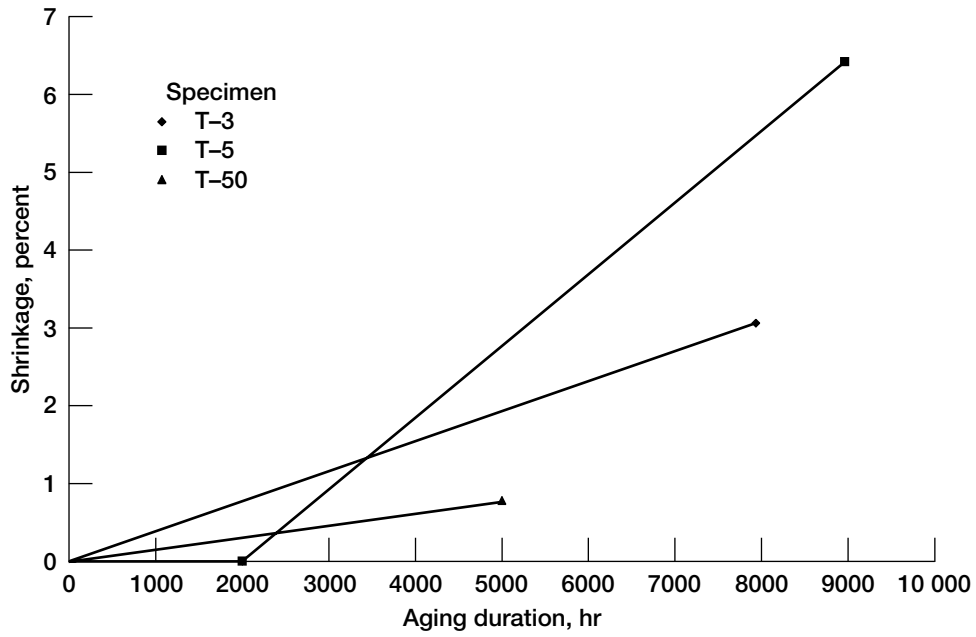


Figure 20.—Shrinkage of T-650-35/PMR-15 composite specimens with aging at 288 °C.

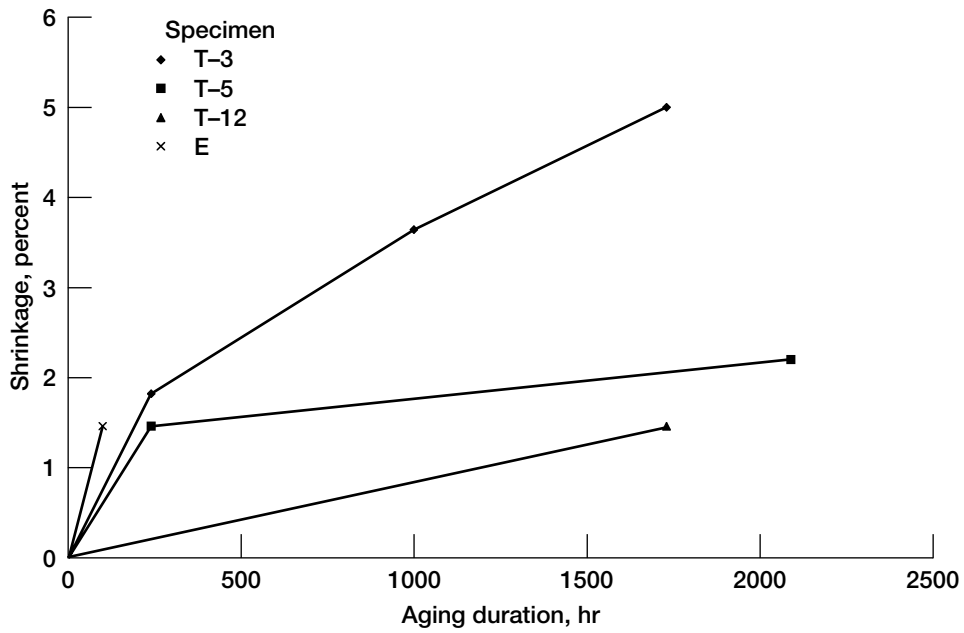


Figure 21.—Shrinkage of T-650-35/PMR-15 composite specimens with aging at 316 °C.

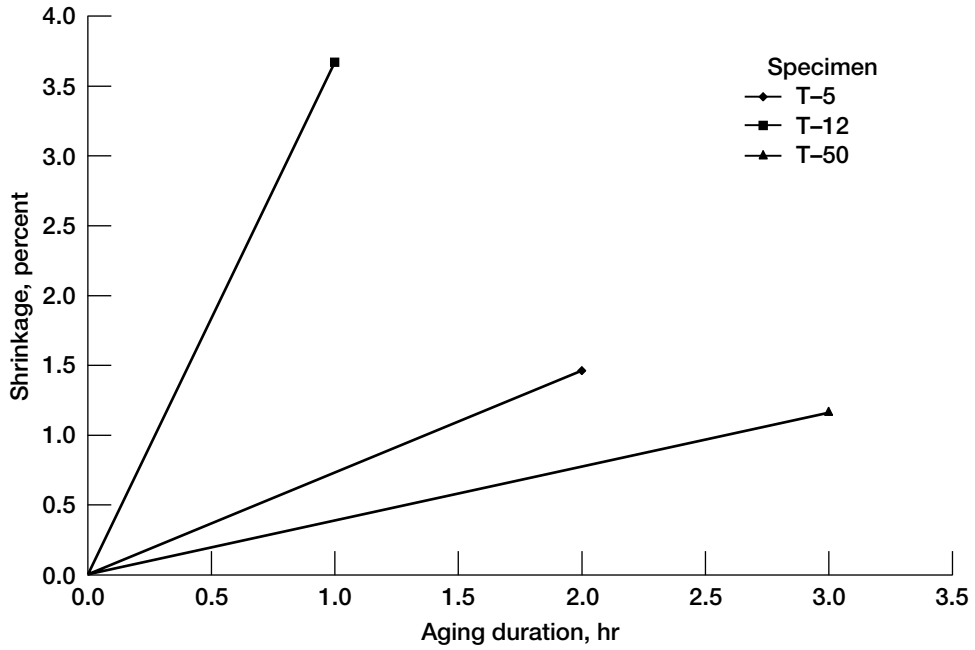


Figure 22.—Shrinkage of T-650-35/PMR-15 composite specimens with aging at 343 °C.

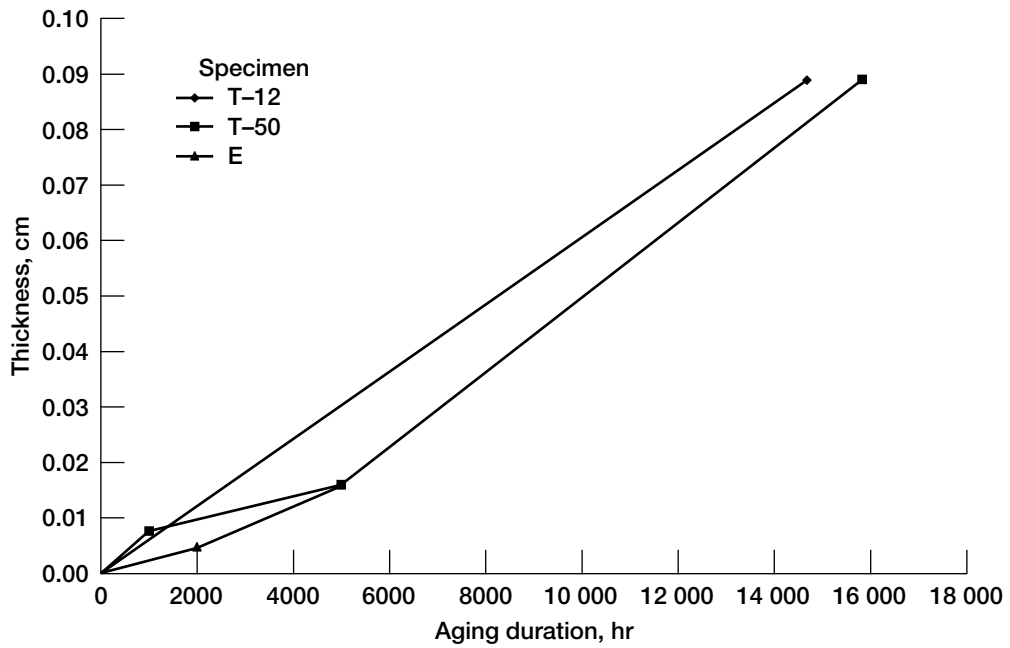


Figure 23.—Surface layer thickness of T-650-35/PMR-15 composite specimens as function of aging at 204 °C.

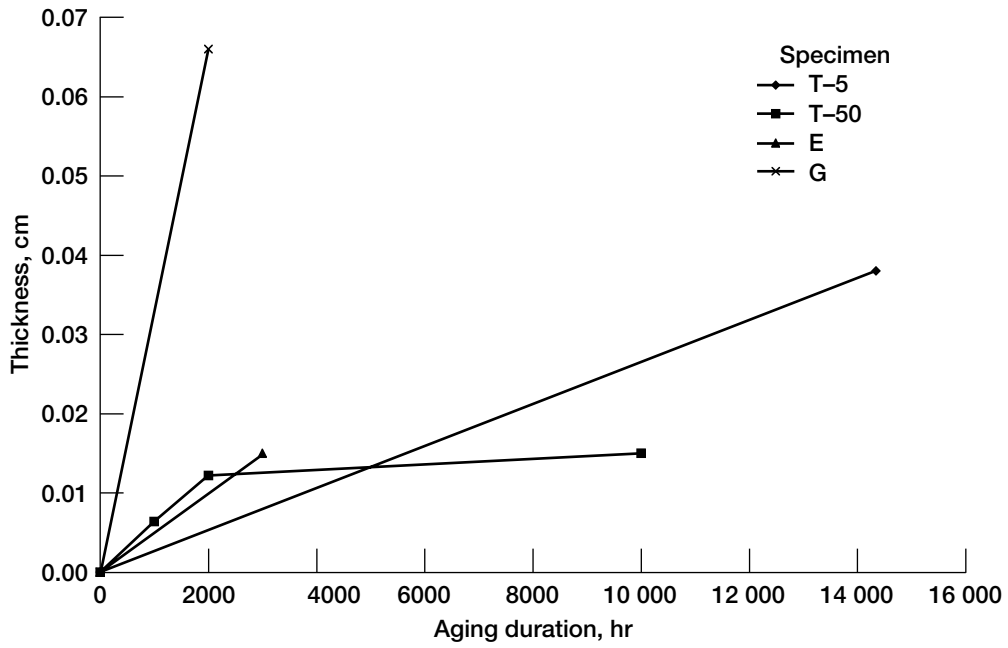


Figure 24.—Surface layer thickness of T-650-35/PMR-15 composite specimens as function of aging at 260 °C.

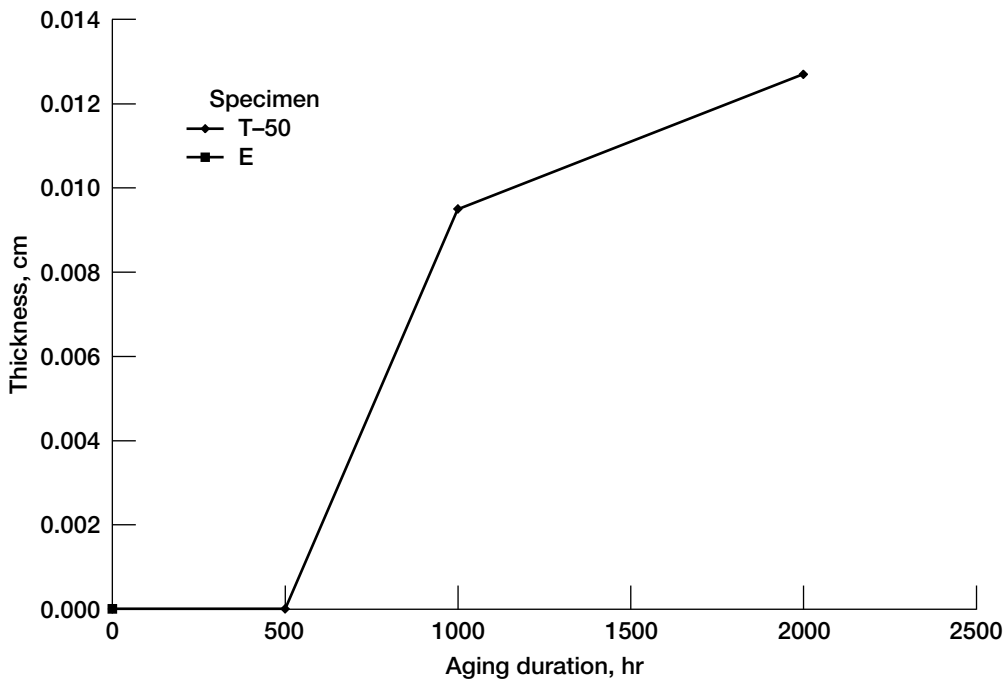


Figure 25.—Surface layer thickness of T-650-35/PMR-15 composite specimens as function of aging at 288 °C.

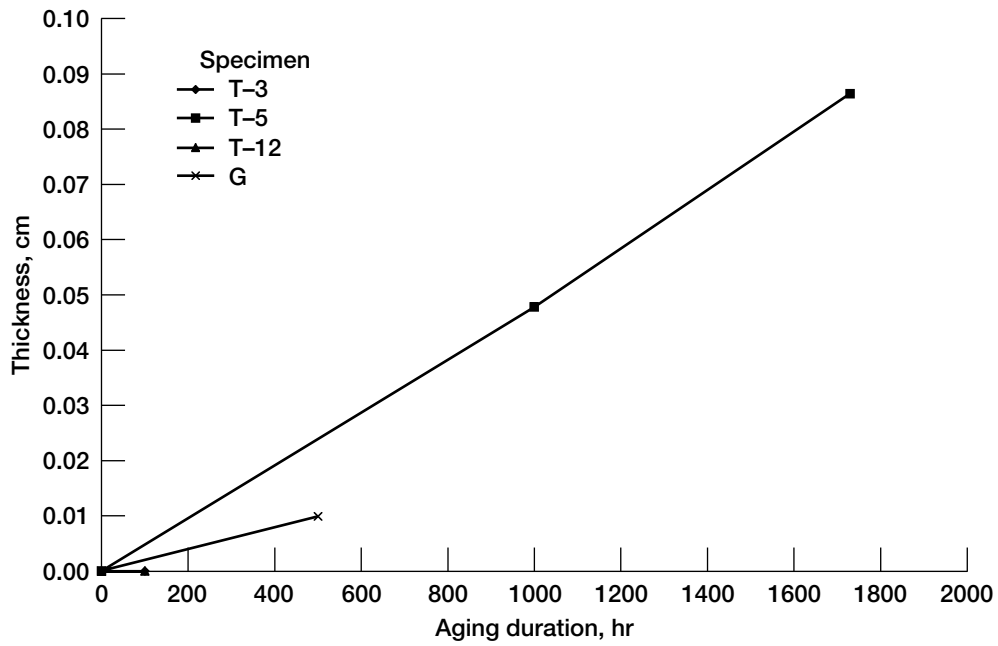


Figure 26.—Surface layer thickness of T-650-35/PMR-15 composite specimens as function of aging at 316 °C.

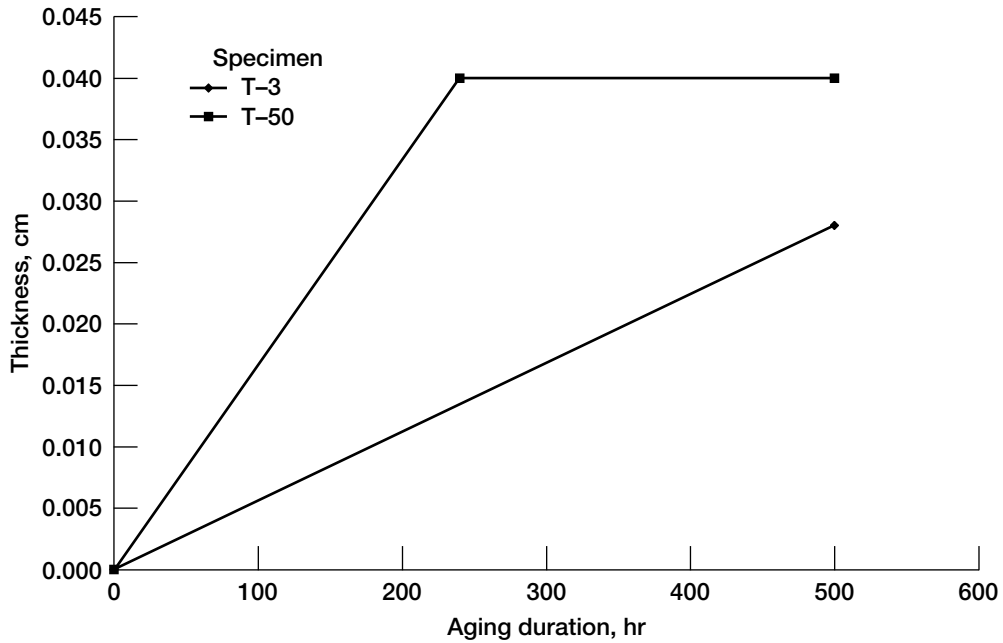


Figure 27.—Surface layer thickness of T-650-35/PMR-15 composite specimens as function of aging at 343 °C.

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<b>13. ABSTRACT</b> ( <i>Maximum 200 words</i> )  A cooperative program was conducted with the General Electric Aircraft Engines plant in Evendale, Ohio, to study the effects of long-term isothermal aging at elevated temperatures on compression and thermal durability properties of T650-35 fabric-reinforced PMR-15 composites. This degradation study was conducted over an approximate time period of 3 1/2 yr. The aging temperatures were 204, 260, 288, 316, and 343 °C. Specimens of different dimensions were evaluated. Specimens with ratios of the cut edge to total surface area of 0.03 to 0.89 were fabricated and aged. The aged and unaged specimens were tested in compression as specified in Test Method for Compressive Properties of Rigid Plastics (ASTM D695M). Thickness changes, degraded surface layer growth, weight loss, and failure modes were monitored and recorded. All property changes were thickness dependent.			
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