Thermography used in test of conductivity of carbon fiber.

- Description: Testing of the ability of carbon fiber to radiatively cool a heat source. The carbon fibers are attached to a heat source. The heat conducts into the fiber than along the fiber away from the heat source. The test are done in a vacuum chamber (10-5 Torr typical). The IR camera is viewing the fiber through a ZnSe window. A thermocouple (TC) in contact with the fiber is at the top right hand side of the area of interest and one is near the bottom. Thin shielding fins, seen edge on, are just above the top thermocouple in Fig 1a.
- Location/Date: MSFC, AL, Radiator Chamber / 18 August, 2012
- Thermographer: Paul Craven
- Measurement setup:
  - Camera: model SC655 with FOL13 lens.
  - IR camera looking through ZnSe window into vacuum chamber.
  - Approximately 0.22m lens to test sample distance.
  - Atmospheric absorption is negligible(in vacuum); Reflective Apparent temperature =20C; Camera range is 100C – 650C.
  - Thermal tuning has been applied to the image in Fig 1a. The span of the temperatures (~70C to 220C) and the level were carefully adjusted in order to more clearly show the temperature gradient along the carbon fiber cloth. The PE Scale with the Glowbow palette is used.
- Problem: Temperature along fiber should be uniform or decreasing, it appears to be neither. See line plot in Figure 1c.
- Comments: Several effects are affecting results. One is associated with the shielding fins. The thin shielding fins (2, one above the other) are actively cooled and this causes the first drop in the line plot. The second and third drop(right to left) are the top thermocouple and the wires to the bottom thermocouple respectively. There is also a change in the emissivity of the cloth(see digital image in Fig 1b of the sample after removal from the vacuum chamber). The green isotherm at the bottom of Fig 1a marks the area of 0.95 emissivity that is expected from this cloth and corresponds to the area marked in Fig. 1b. The remaining surface below the fins appears to have an emissivity of 0.8 resulting in the lower temperatures indicated in the IR image and the line plot. After adjustment for the emissivity as noted above, the line plot is approximately constant at about 140C, more in line with the high thermal conductivity of this material. The emissivity of the thermocouples is unknown so these points on the line plot could not be adjusted.

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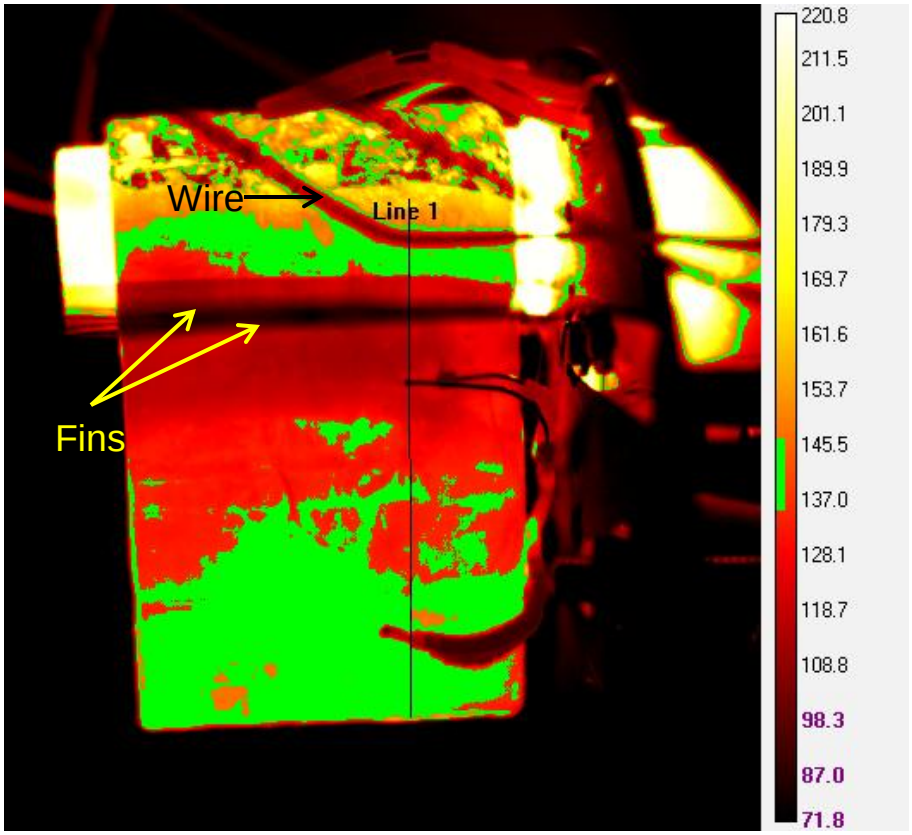

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