N85-32441

SILICON SHEET SURFACE STUDIES

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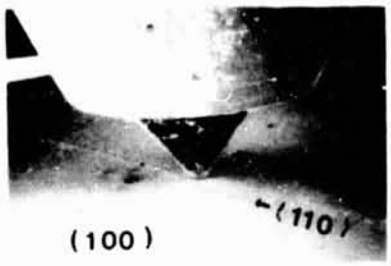
Relative Magnitudes of Residual Stresses in Web and Mobil Silicon Sheet

TECHNOLOGY	REPORT DATE
	October 2, 1984
APPROACH Residual stresses in sheet silicon by interferometry. Simulation of abrasion of silicon by diamond by scratching and indentation tests. **CONTRACTOR**	**STATUS** Developed an interferometry technique for measuring residual stresses in short, thin silicon sheet. Measured the residual stresses in WEB and Mobil sheet. Correlated experimental wear rate with a wear model. Determined the residual stresses due to scratching. Showed that dislocations are associated with scratching and indentations performed at room temperature.
GOALS Develop non-destructive residual stress measurement technique. Determine wear mechanism in silicon.	

SILICON SHEET



(100)

1 Scratch

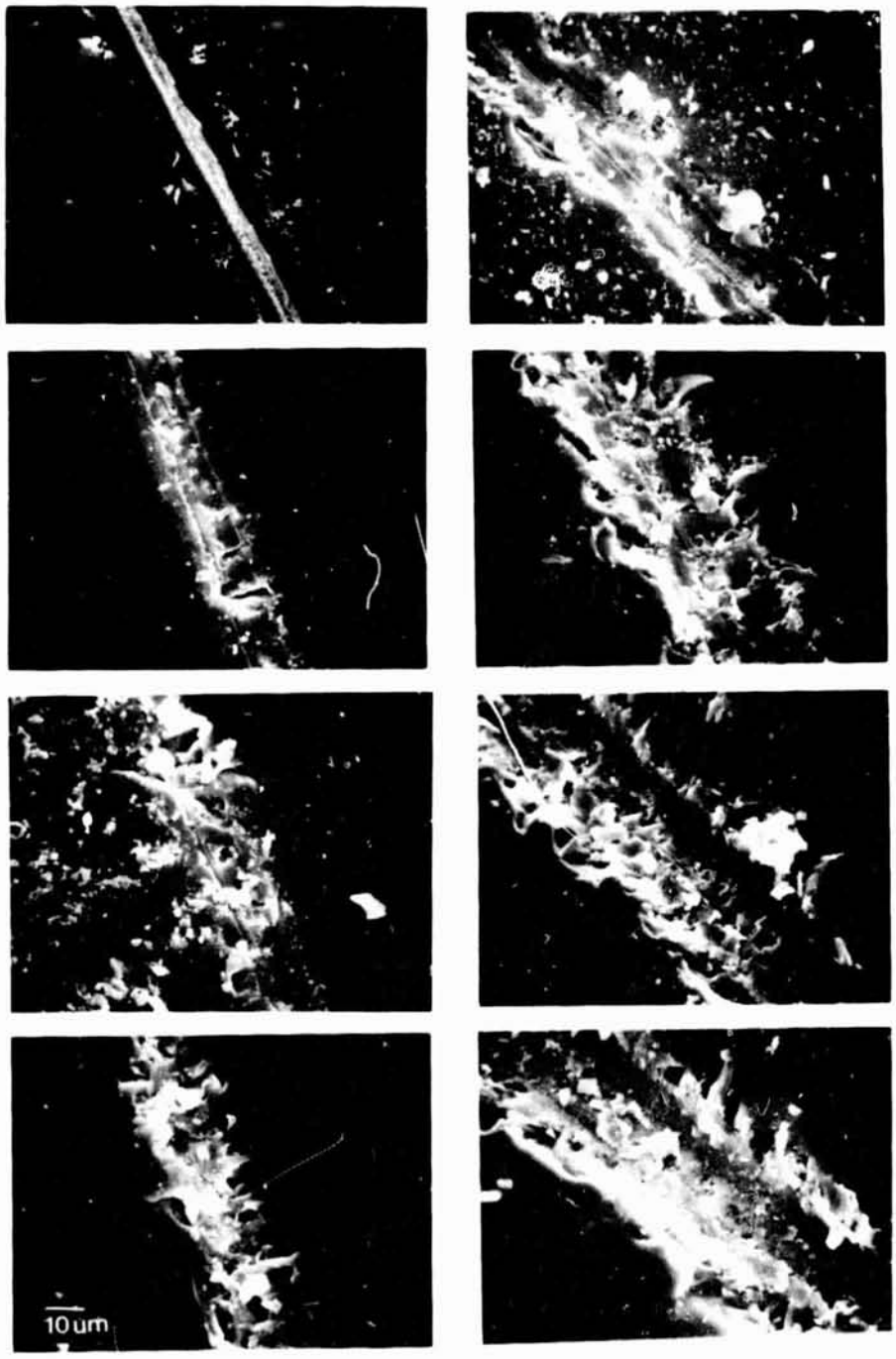
10 Scratches

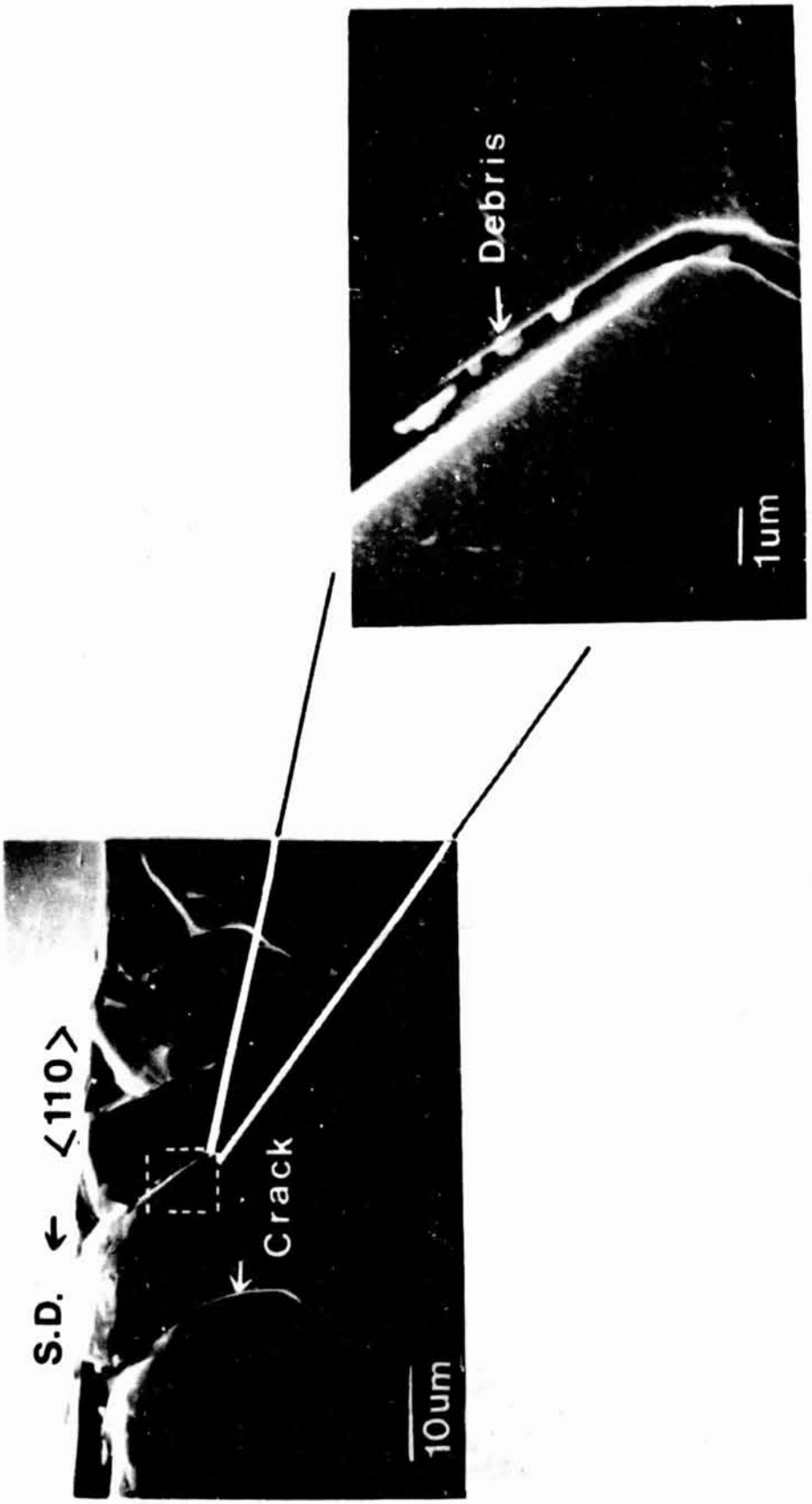
Air

DI H_2O

Acetone

Ethanol





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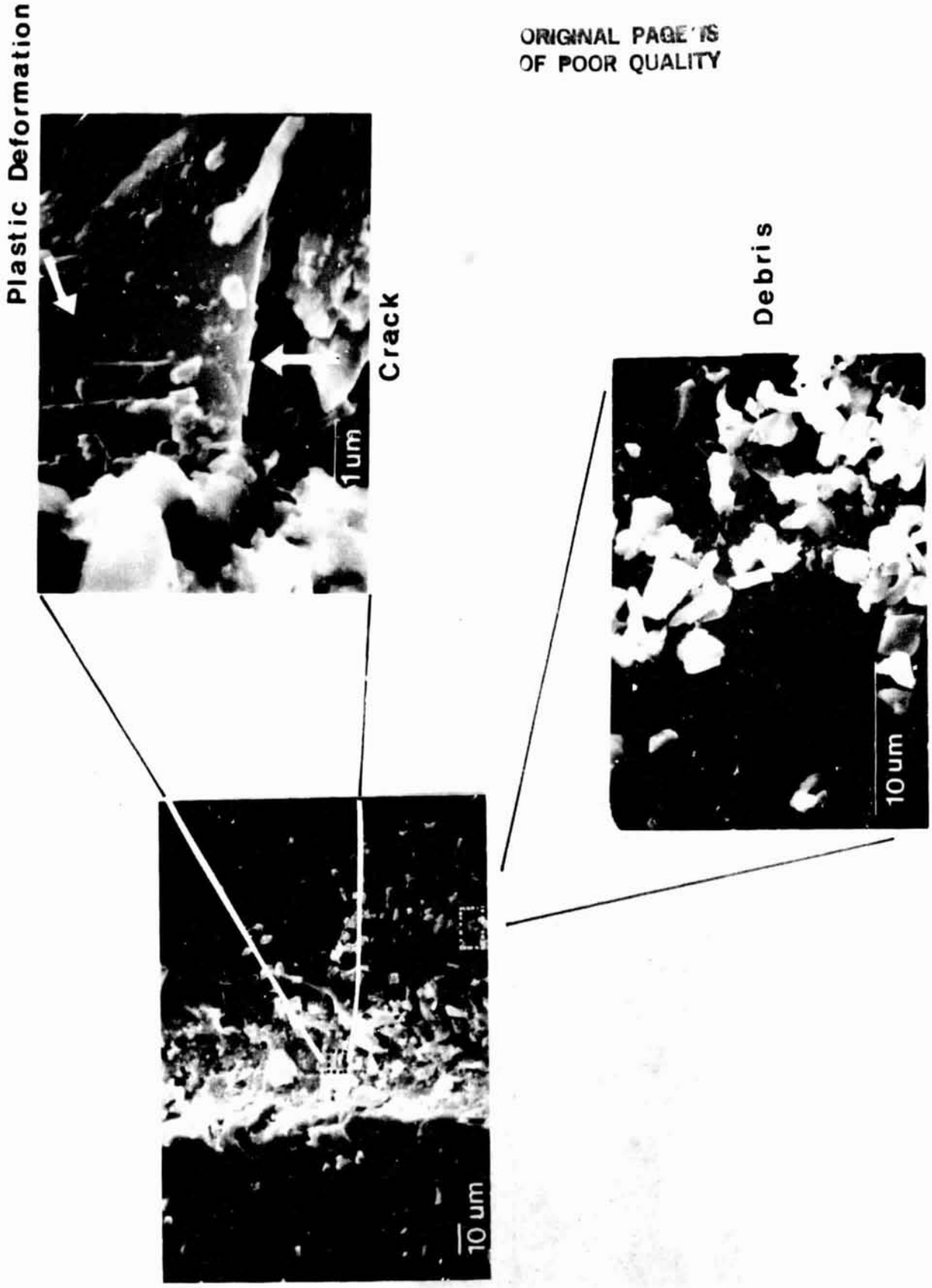
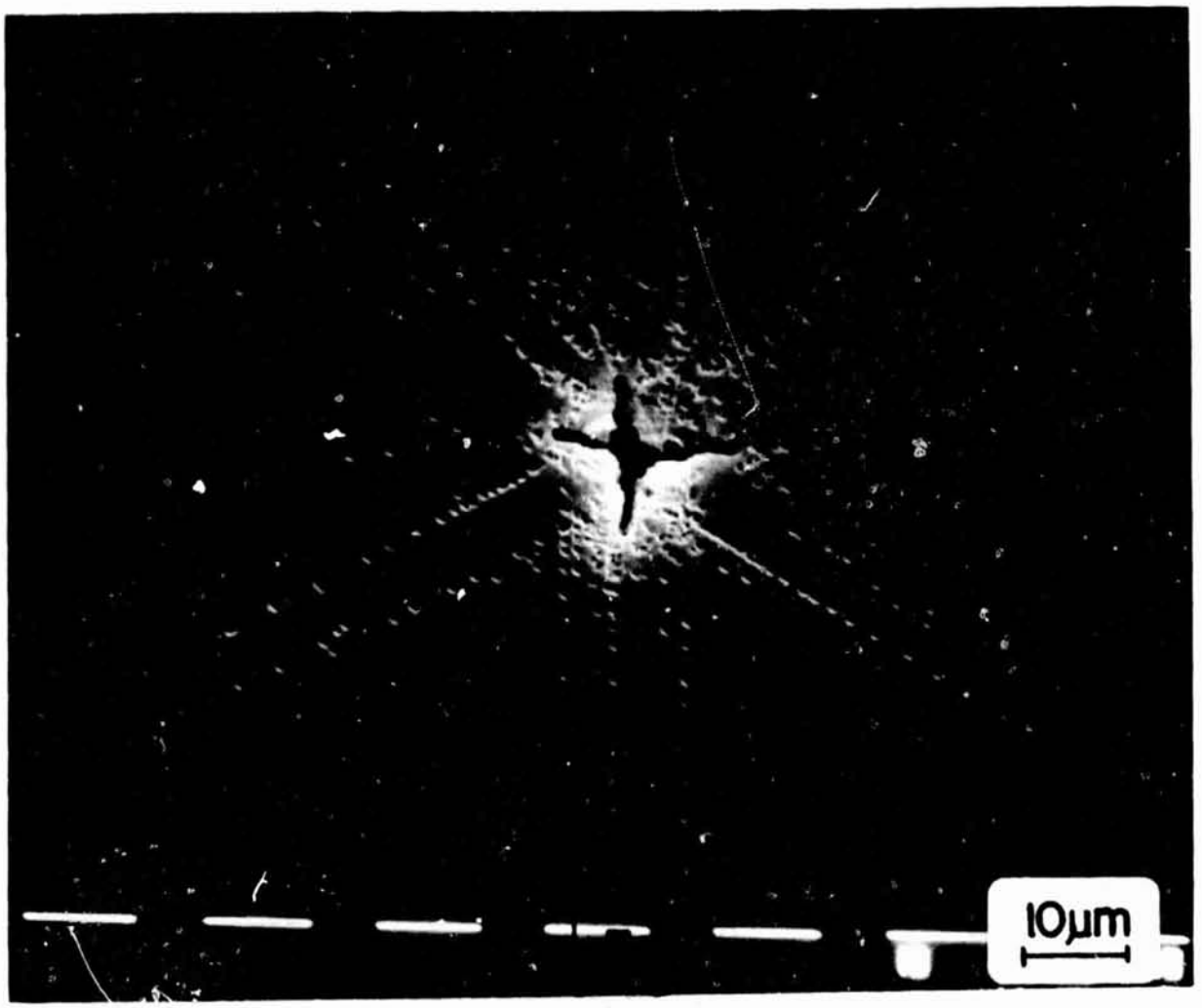
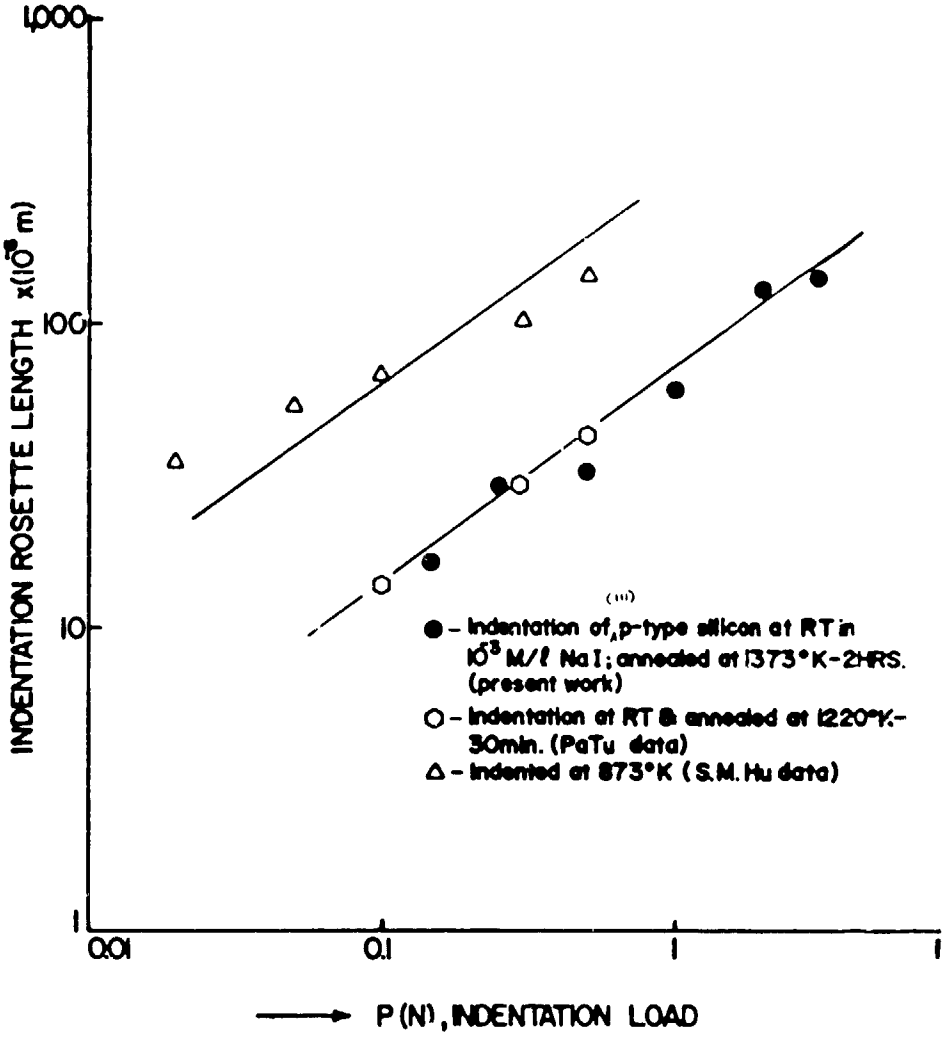
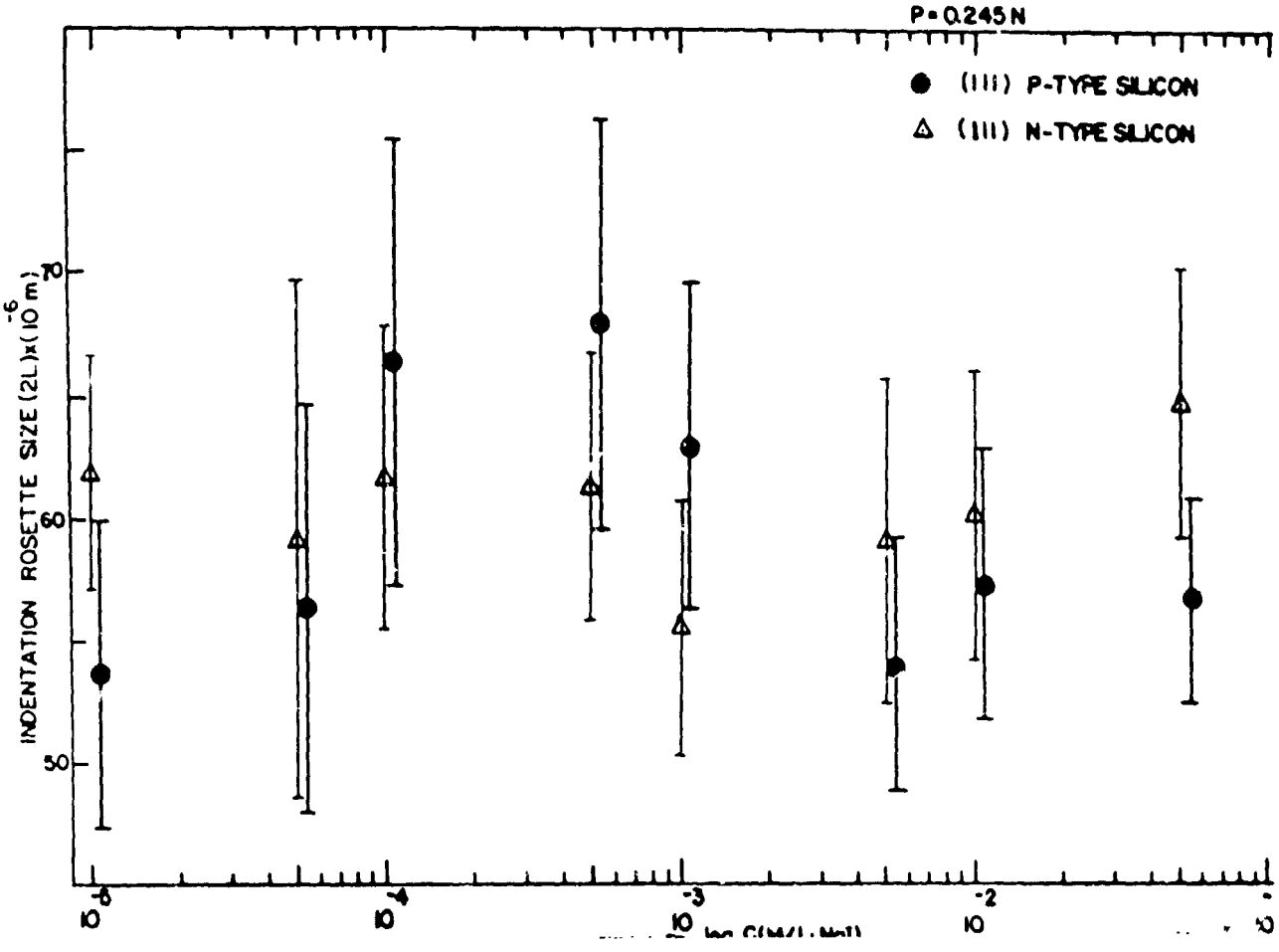


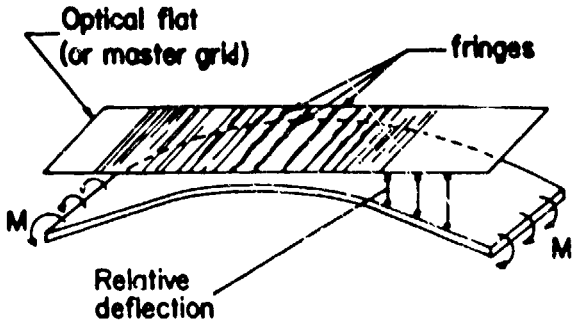


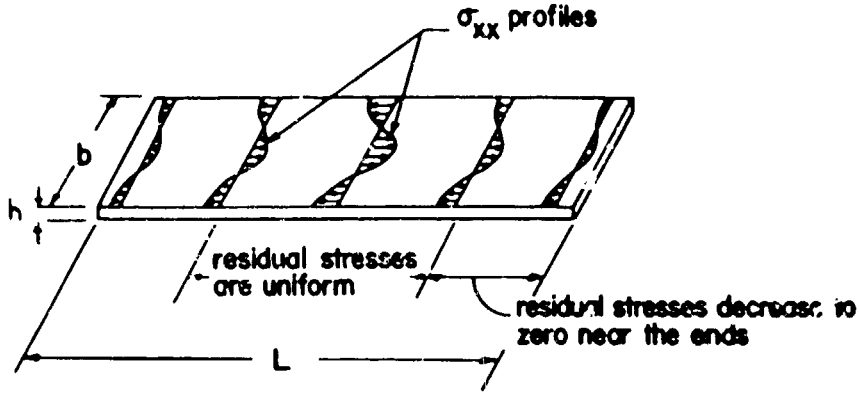
SEM MICROGRAPH OF (111) P-TYPE SILICON INDENTED UNDER A LOAD OF 0.49N IN 10^{-3} M/L NaI; ANNEALED AT 1373 K-2HRS AND ETCHED IN DILUTE SIRTL SOLUTION.

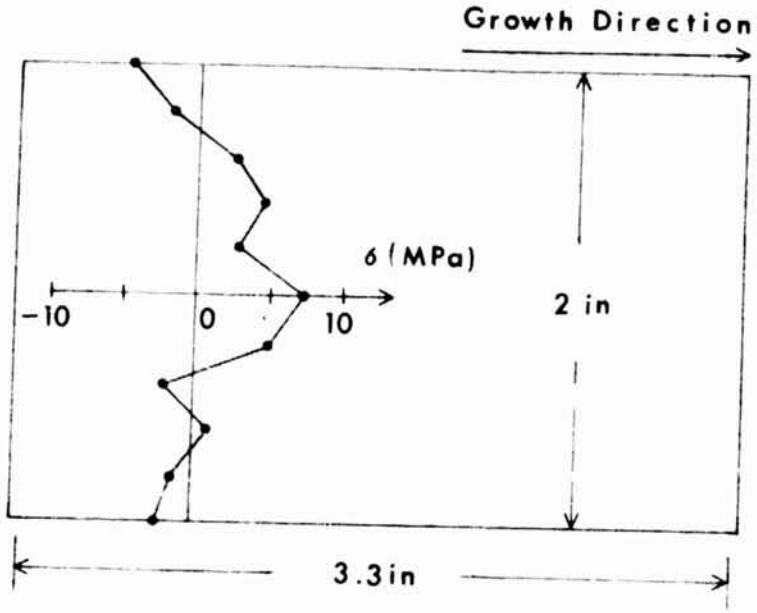
SILICON SHEET

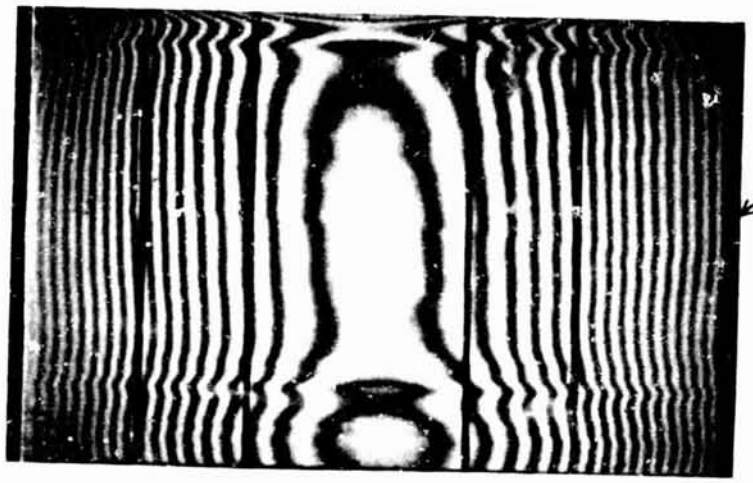


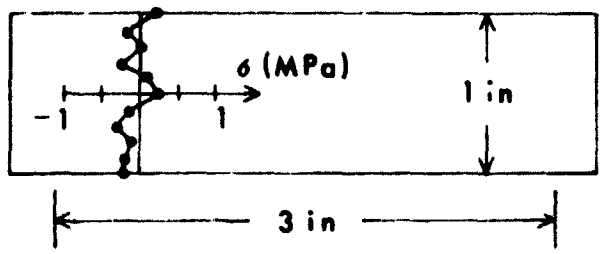

P = 0.245 N
(111) P-TYPE SILICON
(111) N-TYPE SILICON
INDENTATION ROSETTE SIZE (2L)x(10 m)
70
60
50
10
10
10
10

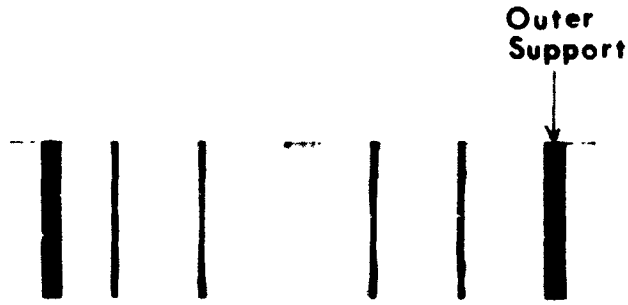

Optical flat
(or master grid)
fringes
M
M
Relative
deflection


σ_{xx} profiles
b
h
t
residual stresses
are uniform
residual stresses decrease to
zero near the ends
L









	Sample No.	Magnitude of Maximum Residual Stress (MPa)	Growth Speed (cm/min)
WEB	J515-2.3a	2.5	
	J460-2.5a	0.4	
Mobil	47R1-1	9.0	2.00
	-2	5.0	2.00
	-3	7.3	1.75
	-4	6.5	2.25

Problems and Concerns

1. Do the residual stress measurements correlate with strain gauge measurements or dislocation distributions?

2. Is the fluid chemistry changed as a result of microcrack or dislocation generation?

3. Does the abrasion mechanism change when abrasion speeds are high? What is the contact temperature.