

Reliability of MEMS in Liquid Environments

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NNIN Facilities utilized: Characterization Facility & Nanofabrication Center

MEMS Reliability in Liquid Environments

- ◆ Microcantilever test structures made of Silicon (uncoated, Titanium coated & SU-8 coated) & Silicon Nitride have been micro-fabricated and tested by vibrating in water, saline, glucose solution, and air.
- ◆ Operational failures studied by monitoring shifts in resonance frequency.
- ◆ MEMS tensile specimen: Fatigue testing of aluminum (Al) tensile specimens in saline and air.

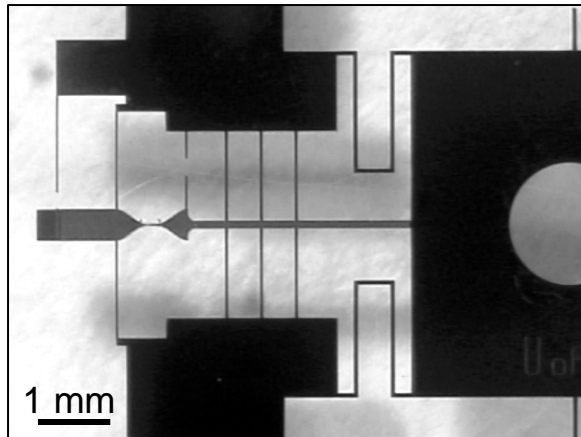


Image of aluminum MEMS tensile specimen for fatigue testing in liquids

Results

Material/Coating	Failure mechanism	Test liquid/Env.
Silicon (uncoated)	Mineral deposition Freq. Shift: 0.4-1.6%	Saline
Titanium coated Silicon	Corrosion fatigue Freq. Shift: < 0.6%	Saline
SU-8 coated silicon	Water absorption & change in intrinsic stresses Freq. Shift: >1.6%	DI Water
Silicon Nitride	No failures	-
Al tensile specimen	Corrosion fatigue	Saline, Air

Conference Paper:

- ◆ S. M. Ali, S. C. Mantell, and E. K. Longmire, "Performance and Reliability of MEMS Coatings in Liquids", IEEE Sensors 2008, Lecce, Italy, Oct 2008, pp. 152-155.

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