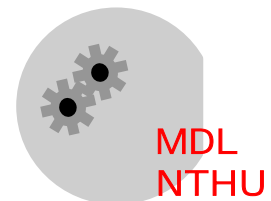


Outline

- 1 Introduction
- 2 Basic IC fabrication processes
- 3 **Fabrication techniques for MEMS**
- 4 Applications
- 5 Mechanics issues on MEMS



3. Fabrication Techniques for MEMS

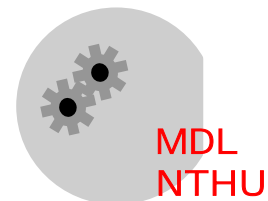
3.1 Bulk micromachining

3.2 Surface micromachining

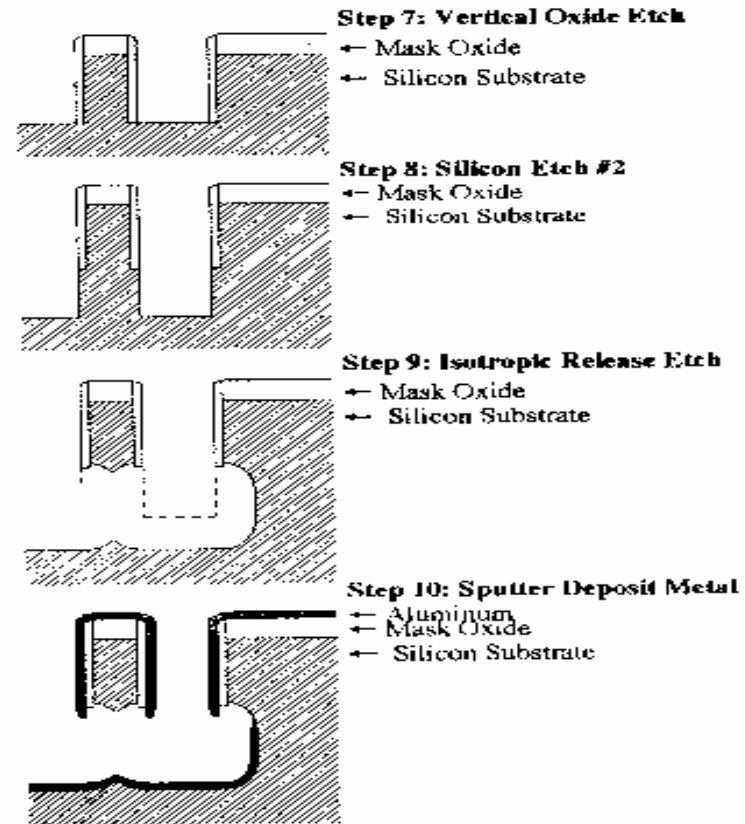
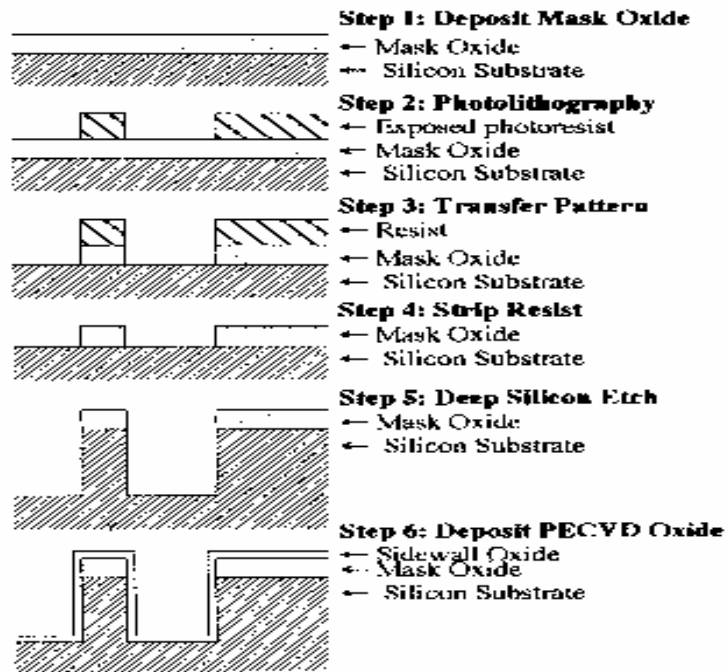
3.3 LIGA process

3.4 Hybrid micromachining

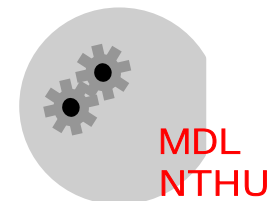
3.5 Thick micromachined structures



SCREAM process



N.C. MacDonald, Transducer'91, 1991



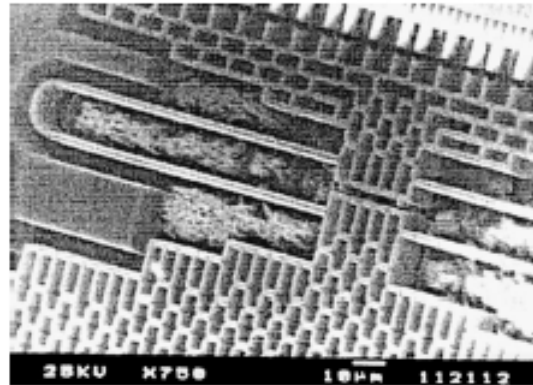


Fig. 7. SEM photo of one tether with stop structure.

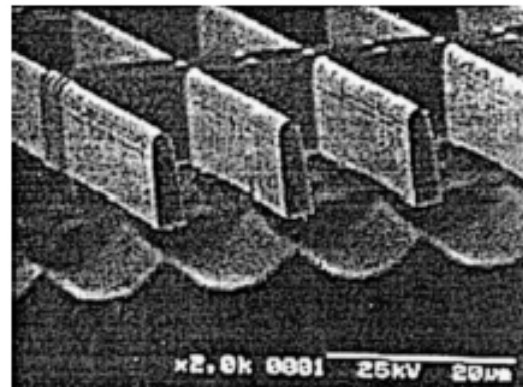
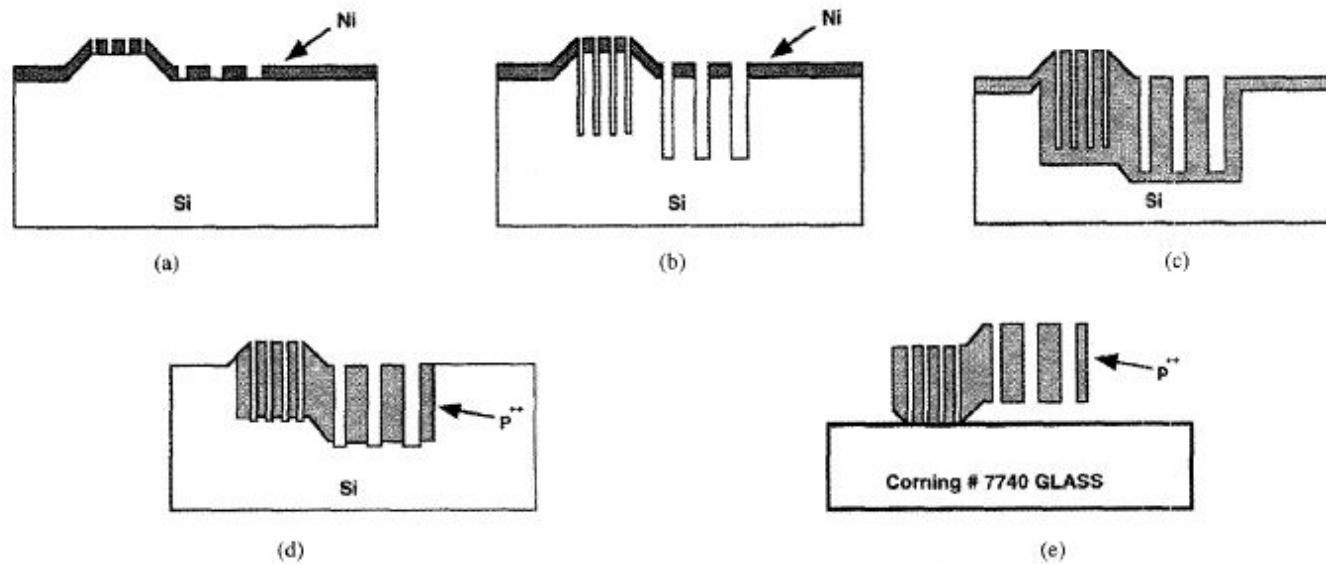


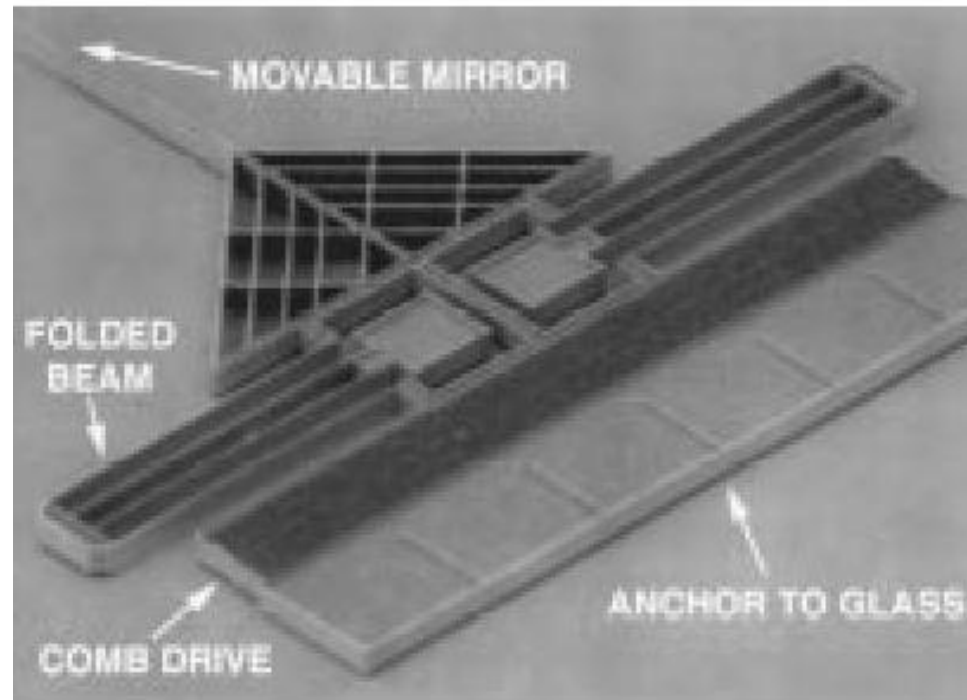
Fig. 8. SEM photo of cross-section of released non-parallel plates.

F.E.H. Tay, Sensors and Actuators A, 2000

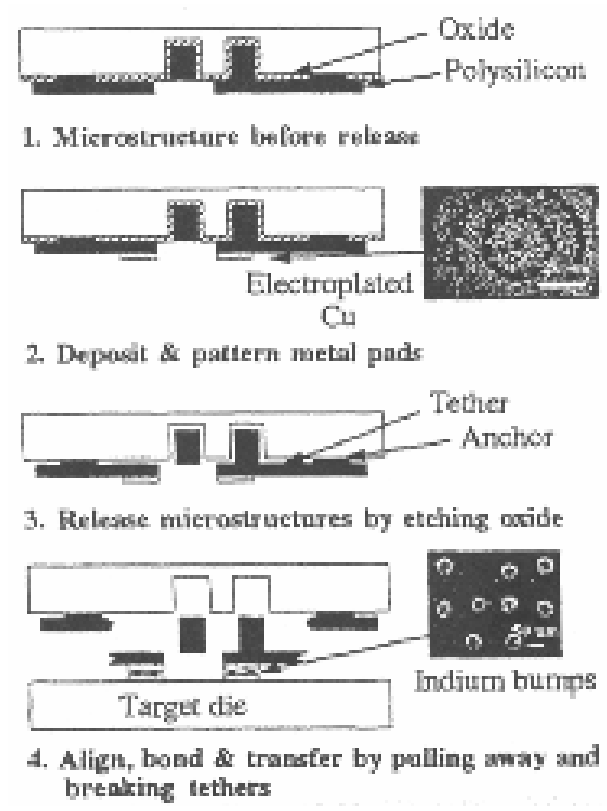
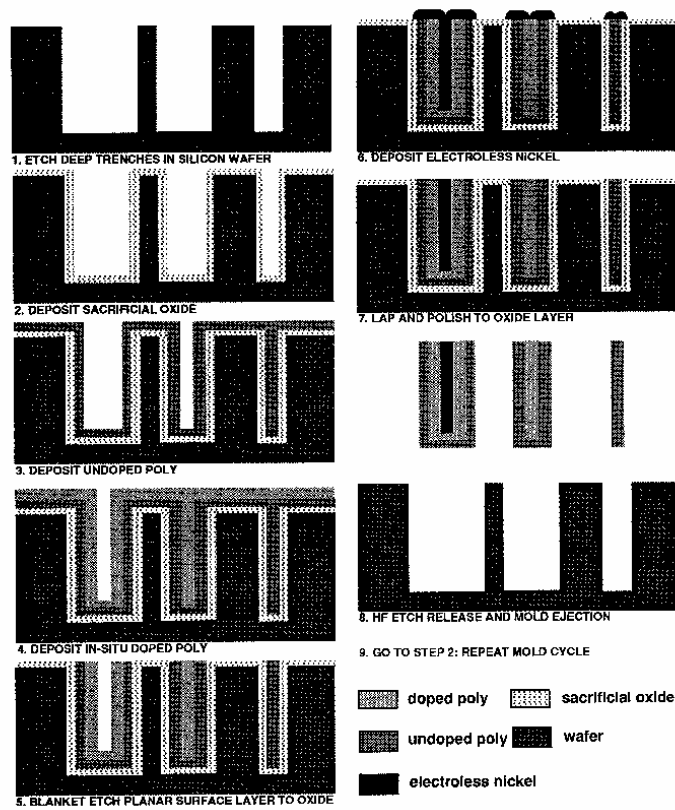
DWP, dissolved wafer process



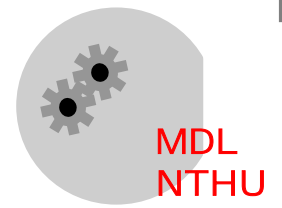
S. Pang, U. of Michigan, 1992



HexSil



R. Howe, UC Berkeley, 1995



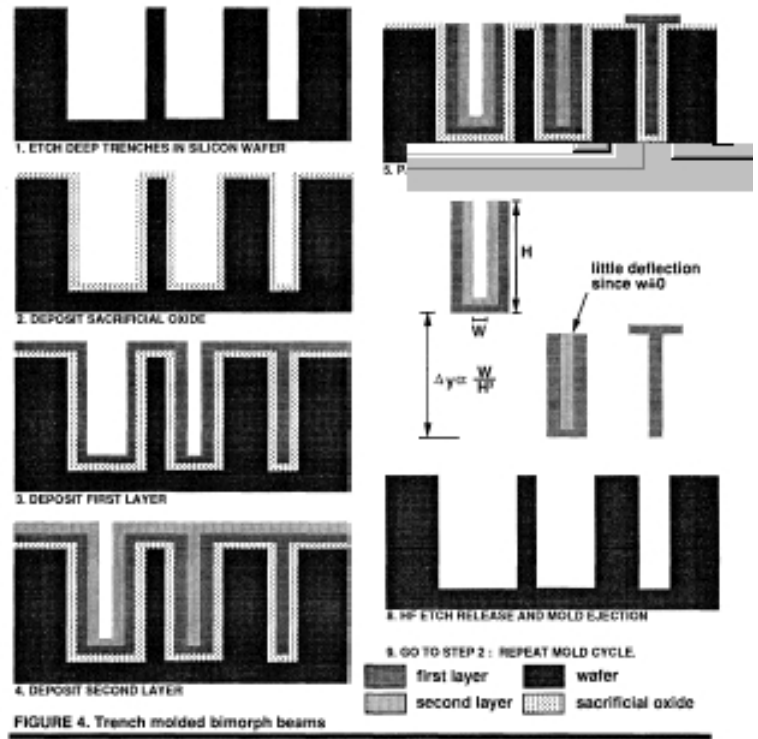


FIGURE 4. Trench molded bimorph beams

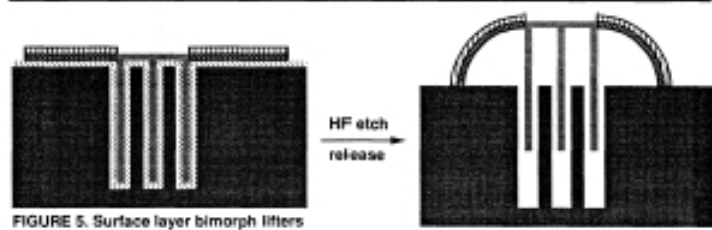
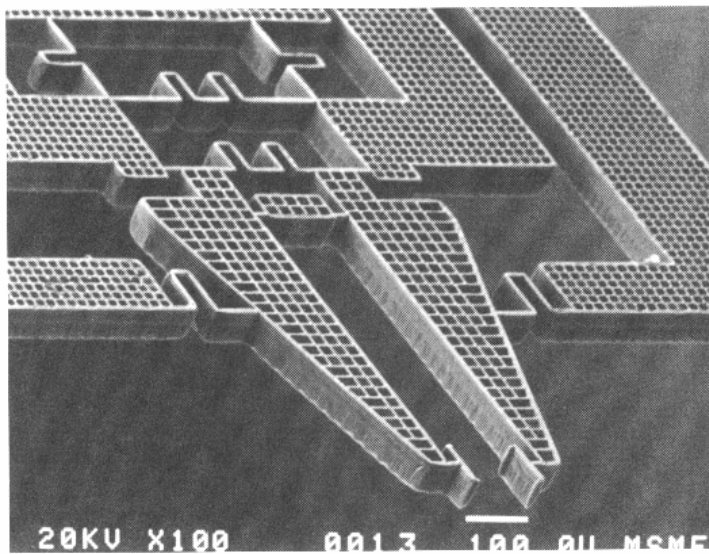
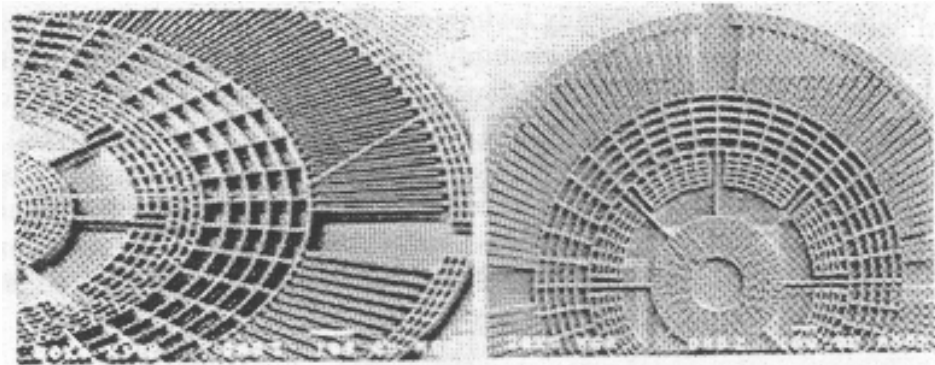


FIGURE 5. Surface layer bimorph lifters

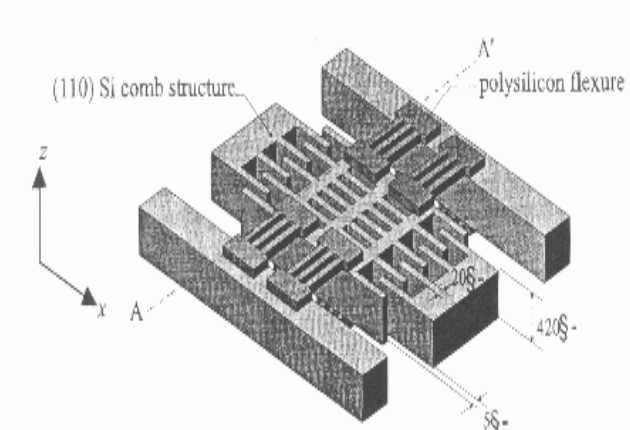
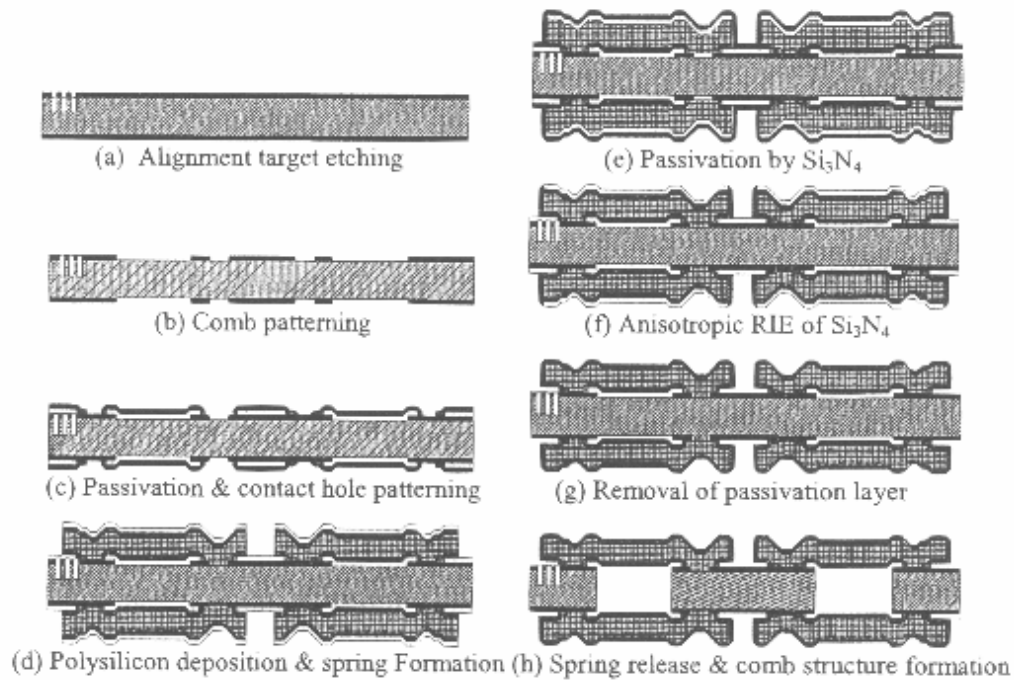
- HexSil tweezers



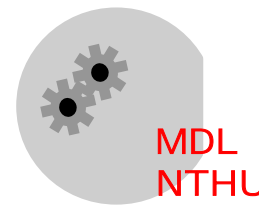
- HexSil comb drive



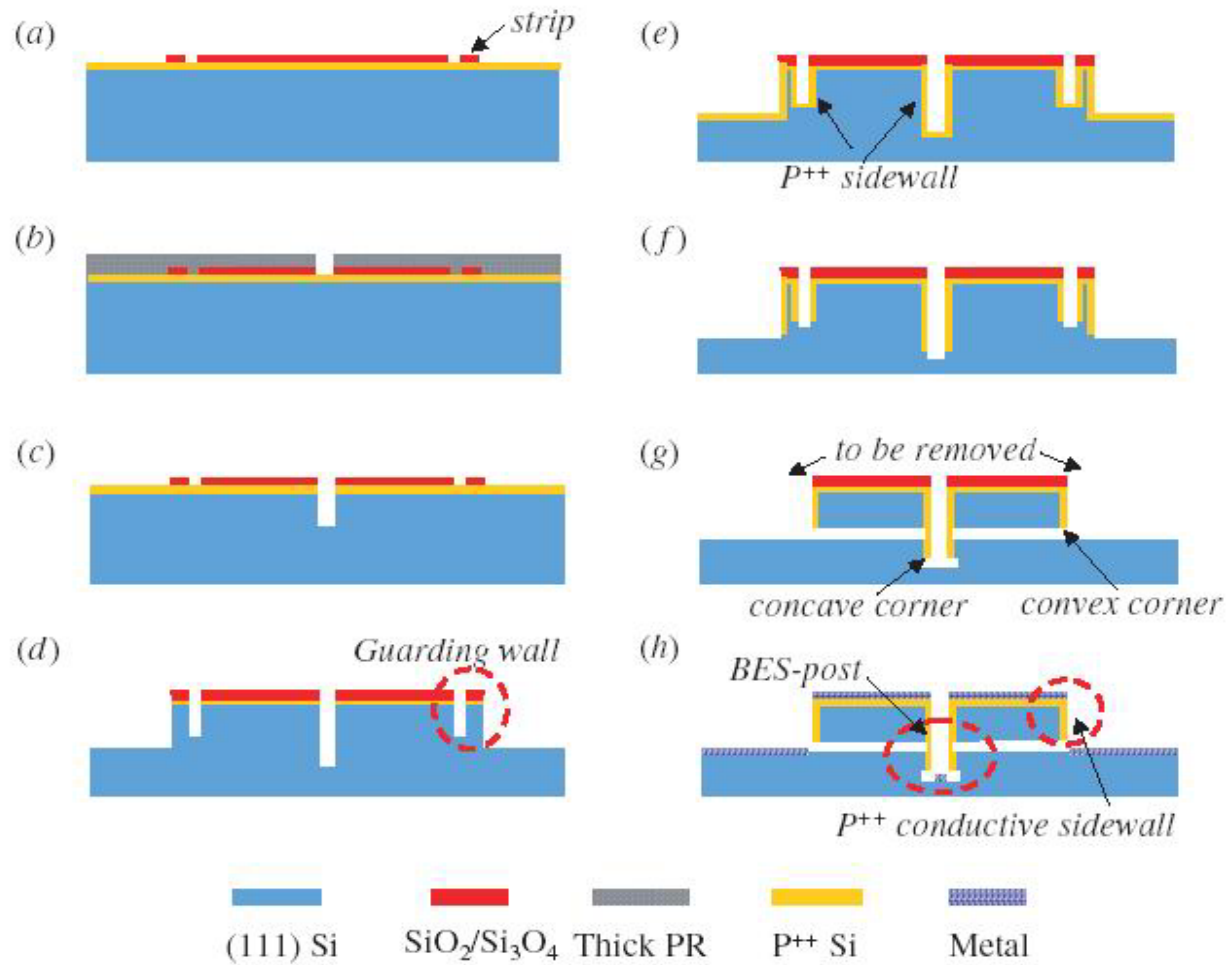
(110) silicon wafer process



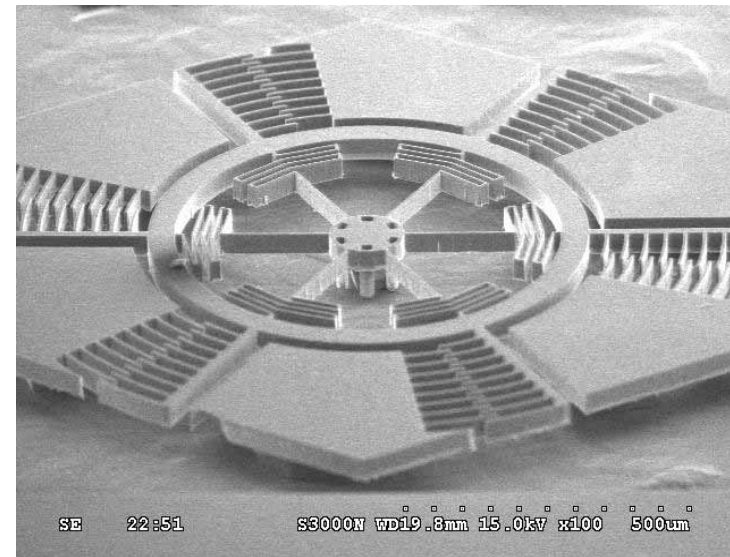
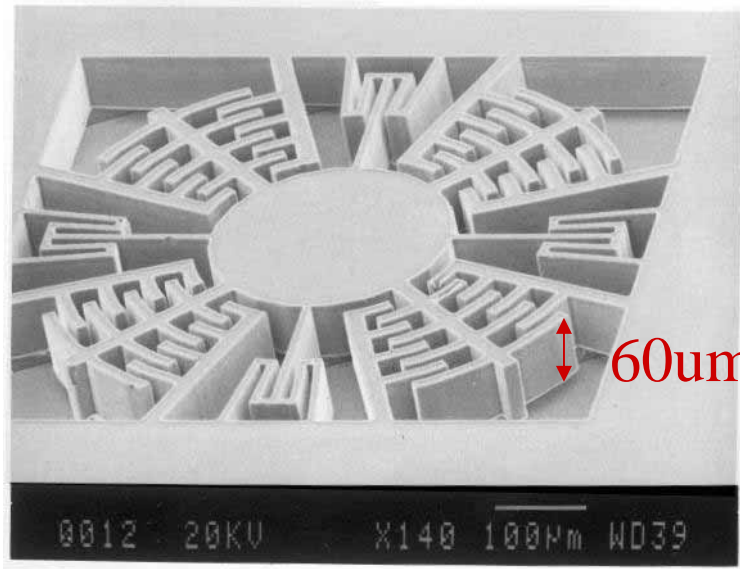
Seoul National University, 1998



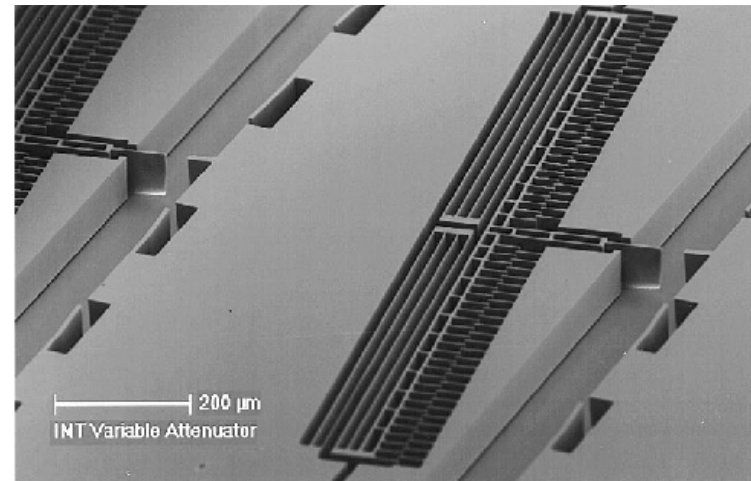
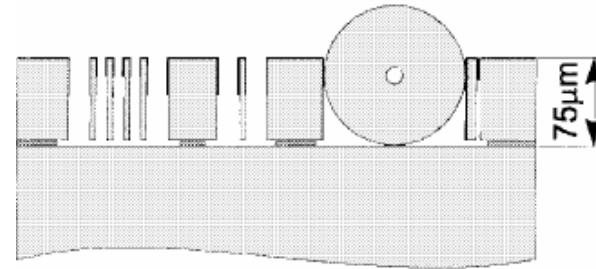
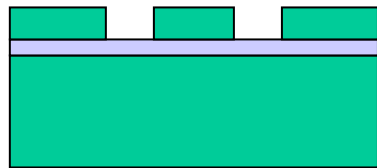
BELST -- (111) silicon wafer process



Micro scanner



SOI wafer process



C. Marxer, N. F. de Rooij, J. MEMS 97