

7.2.4 Summary to: 7.2 Processes and Specialities

MEMS uses all of "known" **Si** technology and has some specifics of its own.

- Making cantilevers and membranes necessitates making "large" cavities.
- Staying absolutely planar and stress-free is essential
- Packaging can be far more demanding than for chips (e.g. transparent tops for **OMEMS**, keeping defined pressures for **> 10 a** in gyros).

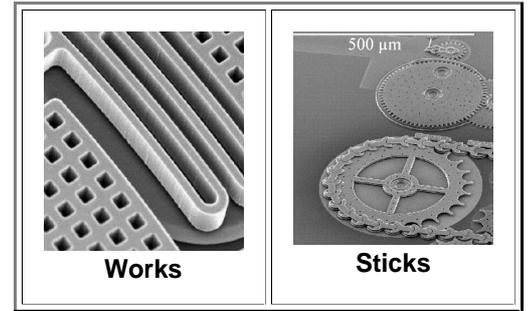
The **bane** of **MEMS** is **stiction**.

- If you can't lubricate, it will stick sooner or later. Never bring moving parts in contact!
- **MEMS** design therefore cannot just miniaturize exiting mechanical designs; it must look for new approaches.

MEMS employs some special processes and materials; they are the drivers of progress

- Anisotropic chemical etching
- High-rate plasma etching ("Bosch process")
- Chemical-mechanical polishing
- Sacrificial layers and removal (including chemical etching with "vapors")
- Wafer bonding; in particular for packaging.

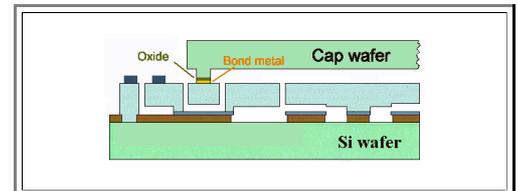
Process integration looks simple if compared to an advanced **CMOS** process, but is actually rather involved due to the special processes needed and quality requirements



Making "large" cavities and extremely deep "holes"

Planarization

Free-standing structures



Exercise 7.2-1

All Questions to 7.2