POLITECNICO DI MILANO

Centre for Computational Structural and Materials Mechanics

FAILURE ANALYSIS OF BRITTLE POLYCRISTALLINE SOLIDS

A. Corigliano, F. Cacchione, A. Ghisi, S. Mariani

Politecnico di Milano, Dipartimento di Ingegneria Strutturale

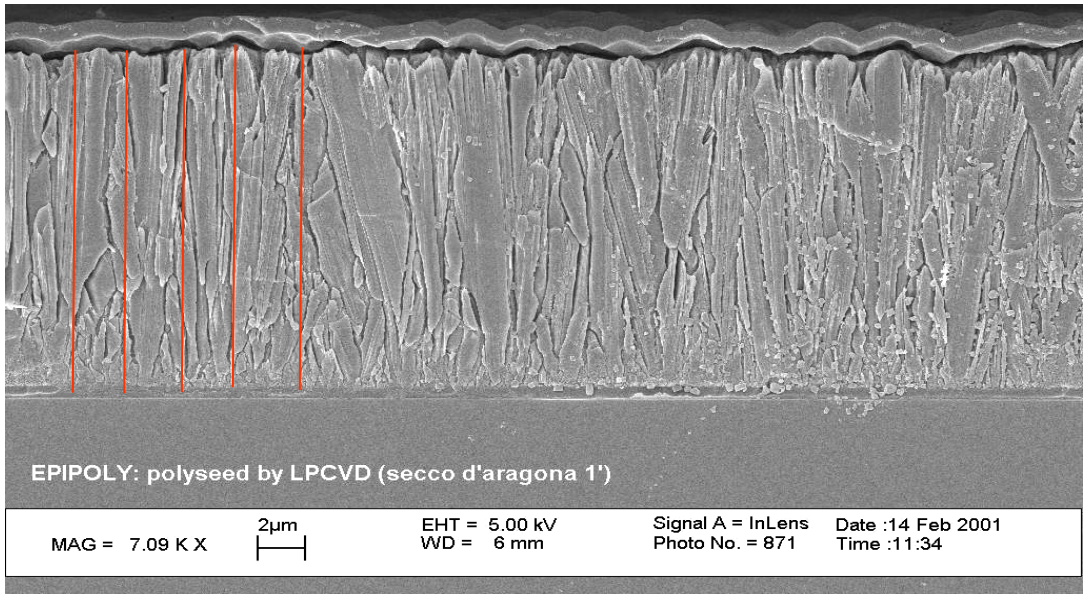
II Riunione Gruppo Materiali AIMETA, Genova, 29 febbraio-1 marzo 2008

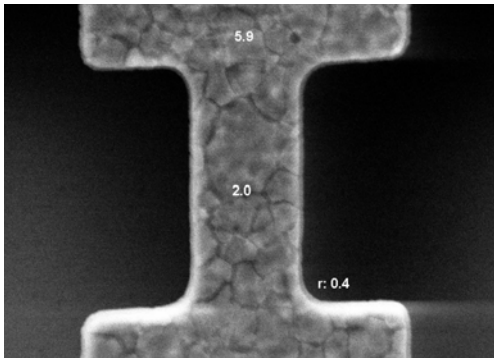
Numerical model of a polycristalline solid

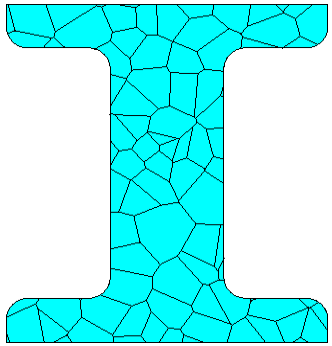
Polysilicon is characterized by an aggregate of crystal grains.

Elastic and fracture properties are influenced by several factors (grain size, grain shape, grain orientation, grain boundary defects,…).

To study MEMS load (shock) carrying-capacity the microstructure has to be taken into account.

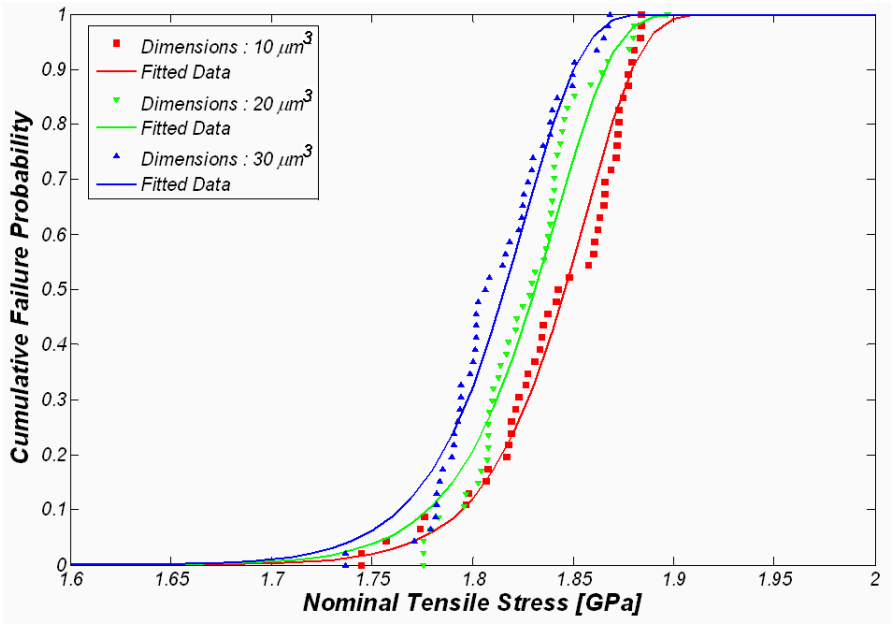




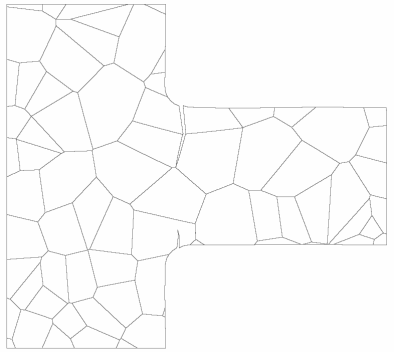


Failure of polycristalline solids

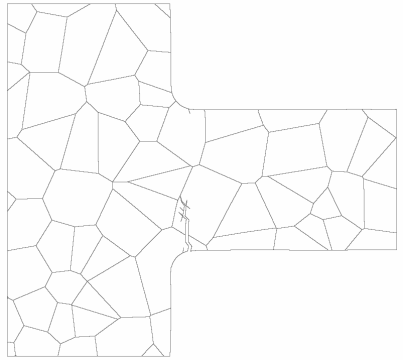
Influence of specimen size on failure probability.



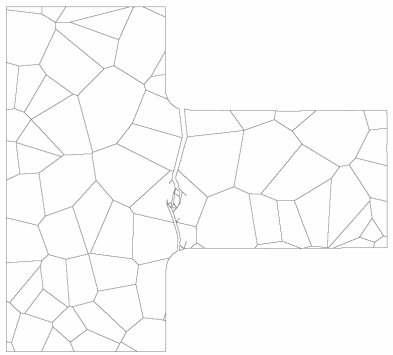
Effects of microstructure on failure.



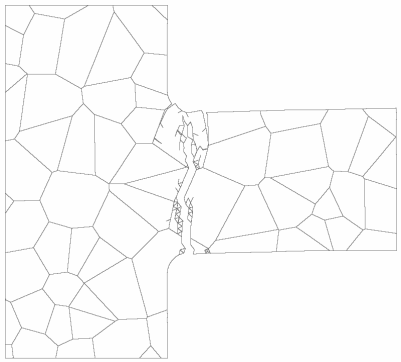
Microstructure A, crack initiation.



Microstructure B, crack initiation.



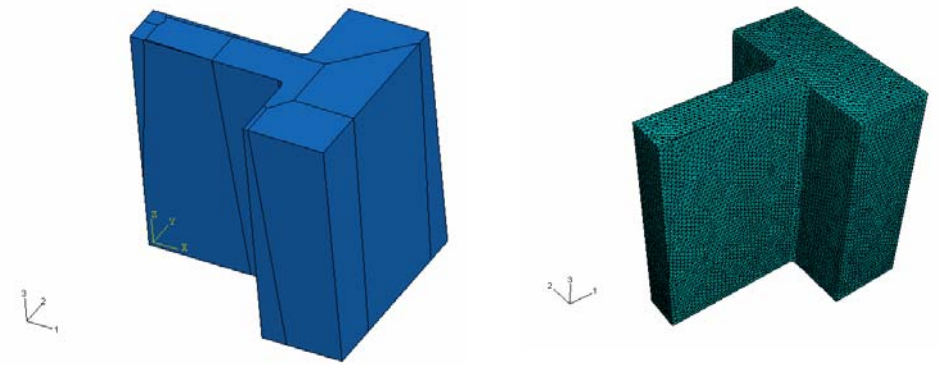
Microstructure A, failure.



Microstructure B, failure.

On going research activities

- 3D simulation of MEMS failure.



- Experimental characterization of polysilicon strength and toughness.
- Effect of anisotropic grain fracture properties on MEMS failure.
- New cohesive constitutive models for grain boundaries.