Microstructural Evolution in Metallic Thin Films using *in situ* TEM Deformation

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**Background**

- Metallic thin films are widely used as structural and functional components in MEMS, where they are subjected to mechanical deformation.
- Uncovering their deformation processes and quantifying how their microstructure evolves during mechanical loading is key to predicting their failure and improving performance.
- Thin films also provide an ideal platform to probe the fundamental deformation mechanisms that operate in nanostructured materials.

**Objectives**

- Quantify grain rotations and microstructural evolution in Al films with different textures using MEMS based *in situ* TEM.

**Results**

**Impact / Future work**

- Orientation changes in hundreds of grains have been tracked simultaneously during *in situ* TEM deformation of ultrafine-grained aluminum films.
- The *in situ* TEM experiments have provided the first direct evidence for reversible grain rotations and grain/twin boundary migration during loading and unloading.
- Quantification of grain growth and linking it to grain and grain boundary characteristics is currently underway.