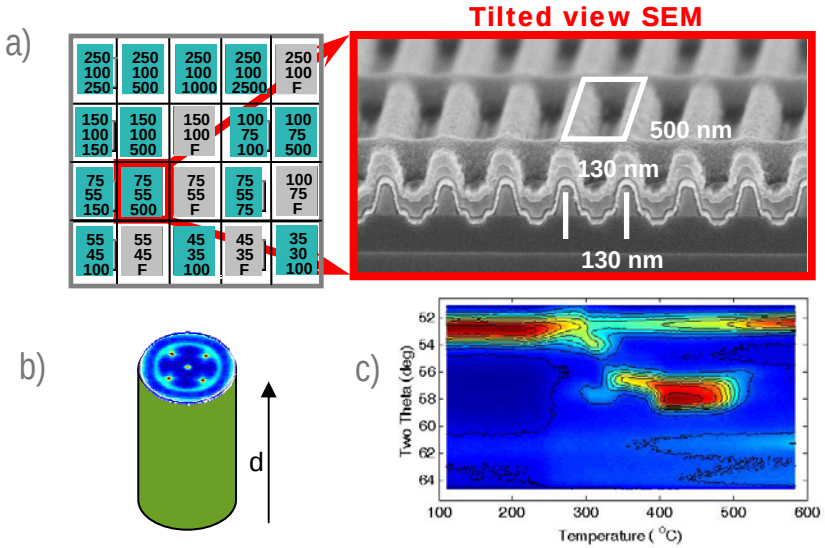
Materials Physics and Processing (MPP)

MPP at NSLS-II

- Real-time, *in-situ* studies of thermal processing of thin blanket films, stacks, and nano-patterned samples
- X-ray diffraction and scattering techniques on solids, with the capability for mounting small environmental chambers, magnets, bending jigs and Displexes

Examples of Science Areas & Impact

- PHASE TRANSFORMATIONS: Crystallization in phase-change memory materials; formation temperatures and kinetics of metal silicide, carbide, and germanide device contacts; barrier failure of metallization liners; formation of lead-free solders. Rapid feedback for microelectronics R&D.
- STRAIN, TEXTURE, GRAIN SIZE: Characterization and control of materials properties that are vital for device performance, including exotic materials for the future.
- MAGNETIC and STRONGLY CORRELATED SYSTEMS: Characterization of magnetic order, with element specificity and spin/orbit selectivity; charge, orbital, and multipolar order; orbital phase; and the effects of spin-orbit coupling and the crystal field environment.



a) New test site developed by IBM and GlobalFoundries provides arrays of nanofeatures with varying width, spacing, and length for systematic studies of scaling. Current projects are Cu lines (texture and stress) and Ni-silicide contacts (transformation T and texture); b) use of linear detector provides 640 simultaneous pole figures for fast, unambiguous grain orientation; c) RTA of Ni silicide formation in a nanostructure array.

Beamline Capabilities

TECHNIQUE(S): 1) *in-situ* rapid thermal annealing (RTA) and isothermals to 1000°C, 2) x-ray scattering in a magnetic field, 3) GIXD, HRXRD, XRR, pole figures, *etc*.

SOURCE: three-pole wiggler, dual-bandpass monochromator

ENDSTATIONS 1) automated, time-resolved RTA, 2) 6-circle diffractometer with 1Tesla magnet

U.S. DEPARTMENT OF ENERGY

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