Phase identification of Cu-Mn diffusion barriers

Beamline: X23A2

Category of Researcher: PRT member

Technique: NEXAFS

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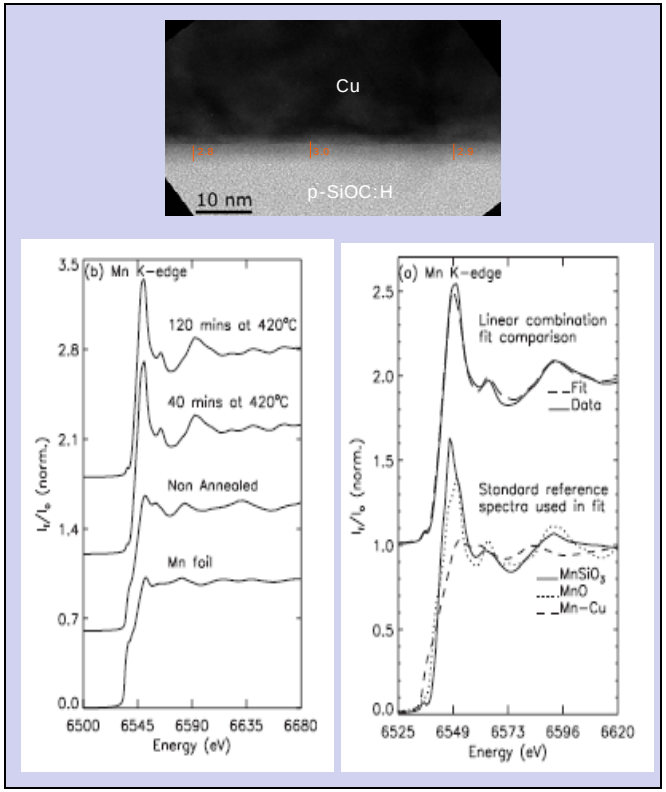
Motivation: Self-forming barriers for Cu interconnects offer a means to provide future technology nodes that cannot be achieved using current thin-film deposition techniques. These layers inhibit failure by preventing Cu diffusion into the dielectric layer. It is therefore imperative to identify the chemical nature and structural properties of the interfacial self-forming barrier.

Results: Both Mn and Cu K-edge EXAFS and NEXAFS spectra of self-forming Cu-Mn diffusion barriers from annealed Cu -8 at. % Mn alloy films on porous low-k and thermally grown SiO_2 dielectrics were studied. For the low-k system, the interface is composed of both $MnSiO_3$ and MnO with near complete Mn segregation from the alloy film; however, the self-forming process does not go to completion on thermally grown SiO_2.



(Top) TEM image of self-forming barrier. (Bottom Left) Mn K-edge NEXAFS spectra from Mn foil and self-forming barrier structure on low-k dielectric. (Bottom Right) NEXAFS standards used to model self-forming barrier and results of linear-combination fit.