Enhanced depth-resolution in multilayer nanostructures from standing-wave excited photoemission

Sven Doering, Delta, TU Dortmund, Germany, Mihaela Gorgoi, Ruslan Osvyannikov, Bessy, Berlin, Germany, See-Hun Yang, IBM Almaden, USA, Mark Huijbens, LBNL, Berkeley, USA, Franz Schäfer, Bessy, Berlin, Germany, Daniel Buerger, Claus Schneider, Forschungszentrum Juelich, Germany, Charles S. Fadley, LBNL, Berkeley, USA; University of California, Davis, USA; Forschungszentrum Juelich, Germany, Walter Braun, Bessy, Berlin, Germany, Carsten Westphal, Delta, TU Dortmund, Germany — The depth resolution for studying buried layers and interfaces in multilayer structures with photoemission can be enhanced by exciting with a standing-wave field created by reflection from a multilayer mirror substrate. Combining experiment with x-ray optical simulations can provide information on depth profiles of different chemical species and their magnetic properties. We have applied this method, using both rocking curves and sample scans over a wedge profile, to several types of samples: bare multilayers of Si/Mo and epitaxial SrTiO$_3$/La$_{0.7}$Sr$_{0.3}$MnO$_3$, and epitaxial MgO on a wedge of Fe on top of a GaAs/AlAs multilayer. Both soft x-ray excitation at the TU Dortmund Delta facility and hard x-ray excitation at BESSY II in Berlin have been utilized, with the hard x-rays for the first time permitting the study of deeper layers and interfaces.

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