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Research

Beamline 8-ID: Dynamics and Kinetics Studies of Nanostructures and Nanocomposites

X-ray photon correlation spectroscopy (XPCS) has found growing applications in the research of nanostructures and nanocomposites in bulk and at surfaces and interfaces. In 2003, operation of undulator beamline 8-ID, where XPCS measurements are a specialty, became part of APS X-Ray Operations and Research (XOR). As a portion of the APS and XOR Strategic and Tactical Plan calling for 8-ID specialization to XPCS, a series of focused tactical and strategic infrastructure improvements have been carried out at the beamline. A permanent staff of four, with diverse scientific interests and backgrounds within the broad themes of XPCS, are available to assist users. The XPCS optical contrast and experiment stability have been increased by approximately 70% and 300%, respectively. These improvements have greatly benefited the scientific program at 8-ID. In particular, at the XPCS-specialized station (8-ID-I), several recent high-profile publications have dealt with the equilibrium and non-equilibrium dynamics of soft matters such as polymer melts, polymer composites, and aging gels [1-3] as well as condensed matter physics [4].

As an increasingly important structural-characterization technique to complement XPCS, grazing-incidence small-angle x-ray scattering (GISAXS) is well-suited for the study of kinetics in nanostructures and nanocomposites at surfaces and interfaces *in situ* and in realtime. To meet the strong demand from the nanoscience community, a dedicated GISAXS beamline has been constructed as a part of the 8-ID-E beamline. GISAXS capability at 8-ID has had a significant impact on the nanoscience research field [5 and Fig. 1], while the anisotropic diffusion properties of nanoparticles in polymer ultrathin films have been revealed for the first time.

General-user beam time at 8-ID has increased from 25% to 80%, providing the scientific community with significantly more access to XPCS and GISAXS.

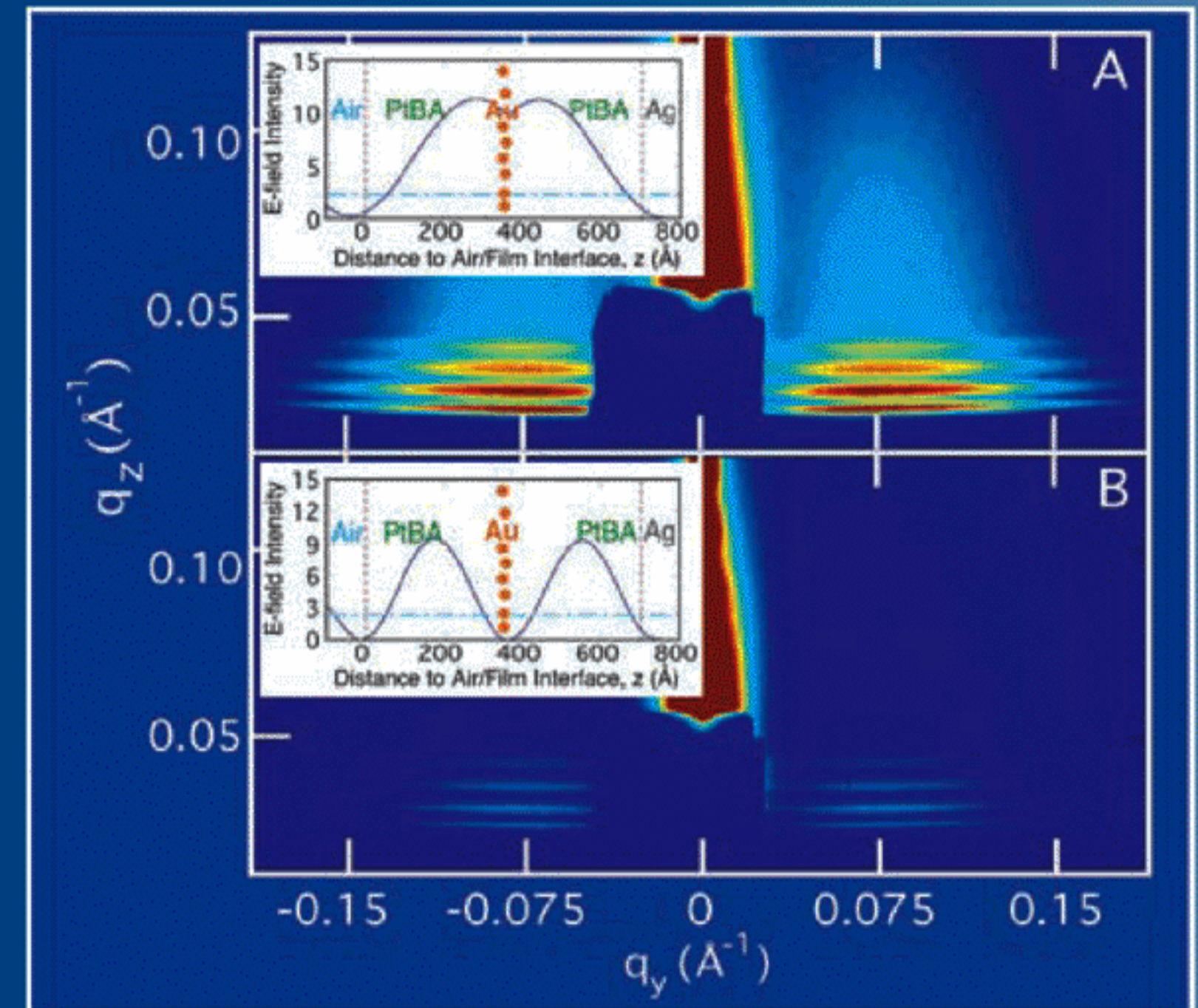


Fig. 1. Normalized resonance-enhanced GISAXS patterns of nanogold particles in an ultrathin polymer wave guide: (A) at the first resonance mode and (B) at an off-resonance condition. The insets depict the corresponding calculated electric-field intensity distributions in the wave guide. The enhancement of the scattering intensity at the resonance condition is readily observable.

References

- [1] P. Falus et al., Phys. Rev. Lett. 93, 145701 (2004).
- [2] P. Falus et al., Phys. Rev. Lett. 94, 016105 (2005).
- [3] R. Bandyopadhyay et al., Phys. Rev. Lett. 93, 228302 (2004).
- [4] A. Fluorasu et al., Phys. Rev. Lett. 94, 055501 (2005).
- [5] S. Narayanan et al., Phys. Rev. Lett. 94, 145504 (2005).

Fourteenth National Conference on Synchrotron Radiation - Detector Workshop

The satellite workshop on detectors scheduled for SRI-2005 at the Center for Advanced Microstructures & Devices in Baton Rouge, Louisiana, has been rescheduled to December 8 and 9, 2005, and relocated to the Advanced Photon Source at Argonne National Laboratory in Illinois. For more information, see www.aps.anl.gov.

Call for Proposals

At the APS, our door is open to experimenters from all scientific disciplines whose research requires the highest brilliance hard x-ray beams in the Western Hemisphere.

General-user proposals for beam time during Run 2006-2 are due by March 10, 2006. Information on access to beam time at the APS is at http://www.aps.anl.gov/user/beamtime/get_beam.html or contact Dr. Dennis Mills, DMM@aps.anl.gov, 630/252-5680.

Argonne National Laboratory is managed by The University of Chicago for the U.S. Department of Energy
The Advanced Photon Source is funded by the U.S. DOE, Office of Science, Office of Basic Energy Sciences

