

Recent Development of Hard X-ray Transmission Microscopy at the 32ID Beamline at the APS*

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Since its commissioning in 2007, the high-energy full-field transmission x-ray microscopy (TXM) at beamline 32-ID of the Advanced Photon Source has made successful achievements in both instrumentation capabilities and scientific applications [1].

We demonstrated the world's top Rayleigh resolution below 30 nm in the hard x-ray regime using home-made Fresnel zone plates [2]. We performed a systematic test on Zernike phase rings and were able to significantly improve the sensitivity, for example, to sub-100-nm nanoparticles used for biological staining by optimizing Zernike contrast. In addition, we have extended the energy capability up to 20 keV, which allows us to perform in-situ/real-time measurements on thick, dense materials and to utilize differential absorption contrast from Co to Mo.

Owing to its high-energy, high-resolution, and high-contrast capability, the TXM has opened up new and exciting scientific applications for materials systems that are too opaque for soft x-rays or electrons, with the scientific aim for real-time and/or in-situ investigation of three-dimensional nanoscale structures. The presentation will focus on both the instrumental details and the applications.

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References

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- [2] Y. T. Chen et al., Nanotechnology 19, 395302 (2008)