X-ray imaging in 2D and 3D with single-digit-nanometer resolution

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X-rays have many appealing properties such as excellent penetration power, high sensitivity to elemental, chemical and structural variations, and inertial to electromagnetic field. These make x-rays ideal nondestructive characterization tools in many areas of science. In recent years owing to breakthroughs in the fabrication of x-ray nanofocusing optics and in data processing algorithms, x-ray microscopy, which provides spatially resolved information, has undergone rapid development and advanced significantly in terms of both resolution and image modalities [1]. In this presentation, we will discuss the latest development at the hard x-ray nanoprobe (HXN) of National Synchrotron Light Source II, which is a scanning hard x-ray microscopy beamline providing 2D and 3D imaging tools with single-digit-nanometer resolution. The ultra-high resolution opens up many exciting opportunities to research problems that are difficult to tackle before. We will showcase a few applications using techniques ranging from 2D imaging (Fig. 1), 3D tomography to nanodiffraction for strain mapping, and discuss current challenges, capabilities and limitations of these techniques.

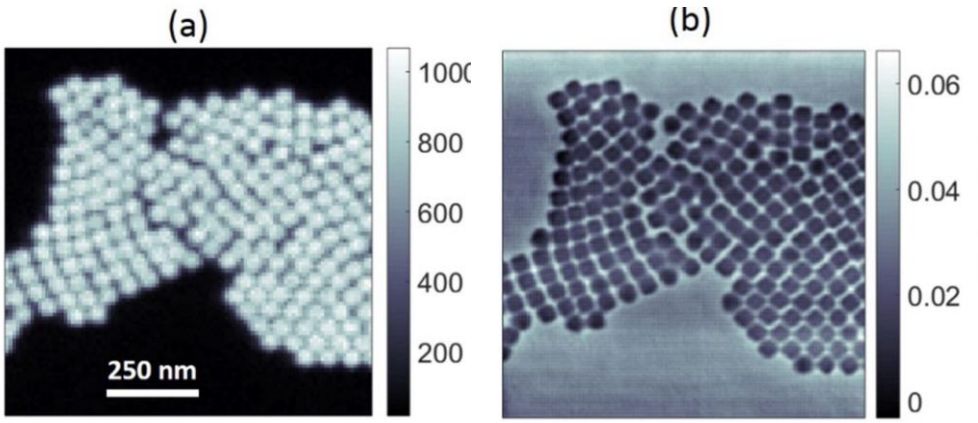

Fig. 1. (a) Fluorescence image of an Au particle array with gaps between them as small as 10 nm. (b) The phase image obtained simultaneously using phase-retrieval algorithm. The gap is well resolved, indicating an image resolution well below 10 nm.

References

[1] H. Yan *et al*., Nano Futures **2**, 011001 (2018).