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TMS 2023

152nd Annual Meeting & Exhibition

MARCH 19–23, 2023
SAN DIEGO CONVENTION CENTER &
HILTON SAN DIEGO BAYFRONT
SAN DIEGO, CALIFORNIA, USA
#TMSANNUALMEETING

SUBMIT AN ABSTRACT BY JULY 1 FOR THE FOLLOWING TMS2023 SYMPOSIUM:

CHARACTERIZATION

Characterization of Materials through High Resolution Coherent Imaging

This symposium will provide a venue for presentations regarding the use of coherent diffraction imaging techniques (x-ray and electron diffraction imaging, ptychography, holography) and phase contrast imaging techniques for high-resolution characterization in all classes of materials. Additionally, modeling and simulation methods that are relevant to nanoscale imaging techniques will be included. A high degree of spatial coherence is an attractive property in x-ray and electron beams. Those from modern synchrotrons and electron microscopes have enabled the development of novel imaging methods. In some cases, these imaging methods provide resolution beyond that achieved with optics and can also provide remarkable sensitivity to a variety of contrast mechanisms.

The two methods that will be the focus of this symposium are coherent diffractive imaging (CDI) and phase contrast imaging (PCI) with both x-rays and electrons. Both explicitly take advantage of the coherence properties of the incident beams. CDI has rapidly advanced in the last twenty years to allow characterization of a broad range of materials, including nanoparticles, strained crystals, biomaterials, and cells. PCI has been widely employed in dynamics and engineering studies of materials, geophysics, medicine, and biology. Various techniques making use of both x-rays and electrons have been developed that provide unique characterization abilities such as three dimensional strain mapping and non-destructive three-dimensional quantitative tomographic imaging. Increasingly, materials modeling at the atomistic and continuum scales is being used in conjunction with these imaging techniques to enhance their capability. Such combined imaging and modeling methods include building experimentally informed models, which are in turn used to make predictions at spatio-temporal scales inaccessible to the imaging technique, and the use of deep learning algorithms trained on synthetic data. These pre-trained deep learning algorithms are being used to improve the quality of acquired x-ray data, reduce experimental measurement times, and also reduce compute time required to recover 3D images from raw data. Finally, as the new 4th generation x-ray light sources (Diffraction Limited Storage Ring or DSLR) come online around the world such as the ESRF in France or APS in Argonne National Laboratory, these brilliant and coherent x-ray sources will become increasingly important and applicable to those wanting to understand materials behaviors at the mesoscale to nanometer scale.

Our 2023 symposium will have a special session dedicated to imaging experiments at these exciting new sources and their applications to materials. Areas of interest include, but are not limited to:

- All x-ray based techniques including Bragg CDI, Fresnel CDI, ptychographic CDI, propagation phase contrast imaging, interferometry imaging, and analyzer based phase-contrast imaging
- All electron based techniques including ptychography and electron CDI
- Computational and simulation efforts with overlap in high resolution imaging
- Big data analytics and machine learning methods to accelerate data abstraction and improve image quality
- All structural and functional materials systems needing high resolution imaging
- Industrial applications
- Development of new techniques and new sources

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