

Multi-Length-Scale & Multi-Dimensional X-ray Microscopy & the related Scientific Data Mining

Yijin Liu

SSRL, SLAC National Accelerator Laboratory, Menlo Park, CA 94025, USA

liyijin@slac.stanford.edu

Studies of complex heterogeneous systems, e.g. research in functional materials and geoscience, usually require a suite of analytical tools that are capable of providing complementary information at different length scales with different contrast mechanisms. This is because the heterogeneity of the complex system usually exists across a wide range of length scales. The complexity in such studies usually leads to large scale scientific big data acquisition posing a major challenge in modern research.

In this presentation, I will show the strength of correlative multiple-length-scale multiple-dimensional X-ray microscopy (at Stanford Synchrotron Radiation Lightsource and beyond) by briefly presenting a few selected scientific case studies including 1) study of underground formation for CO₂ sequestration [1]; 2) study of complex heterogeneous catalysis material for petroleum refining [2]; and 3) study of the rare-earth element based permanent magnet material [3].

These scientific cases serve as good examples to show the link between the macroscopic behavior and the microscopic properties at multiple length-scales. The data mining aspect of the X-ray imaging based studies will be highlighted.

Reference

- [1] ^aYang *et al.*, *Sci. Rep.* **5**, 10635 (2015); ^bHingerl *et al.*, *Int. J. Greenh. Gas Control* **48**, 69–83 (2016).
- [2] ^aMeirer *et al.*, *Sci. Adv.* **1**, e1400199 (2015); ^bMeirer *et al.*, *J. Am. Chem. Soc.* **137**, 102–105 (2015); ^cLiu *et al.*, *Nat. Comm.* **7**, 12634 (2016).
- [3] ^aKao *et al.*, *Microsc. Res. Tech.* **76**, 1112-1117 (2013); ^bDuan *et al.*, *Sci. Rep.* **6**, 34406 (2016).