

**Synchrotron Radiation-based Computerized Tomography on Micro-nano-CT  
Imaging in Shale Structure Analysis**

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With the development of nonconventional oil and gas exploration, microscopic analysis of mineral distributions in shale receives much more attention in recent years. Meanwhile X-ray computerized tomography (CT) based on synchrotron radiation (SR), as a non-destructive technique, becomes an important tool and can be applied to the study of morphology, microstructure, transport properties and fracturing of shale. Traditional methods such as optical and scanning electron microscopy (SEM) are common tools for providing valuable information of microstructures; however, those surface observations are often inadequate in obtaining detailed 3D information of the sample, such as compositional distribution inside the shale. Moreover, samples of shale are usually damaged during serial sectioning. Therefore two scientific issues rose: one is how to generate high level reconstructed image data using SR-CT, another is how to use these CT image data to analyze compositional microstructures. The speaker and his research group study sparse regularization methods for reconstruction of image using SR-CT data. In addition, they study microstructure prediction with a volume of material on a simple cubic lattice, where each site, or voxel, represents a small region of space containing a mixture of compositions forming the material. Numerical experiments are performed to show feasibility of their algorithms.