IBS Center for Molecular Spectroscopy and Dynamics

COLLOQUIUM

- **SPEAKER**
  Prof. Jungwon Park (Seoul National University)

- **TITLE**
  Real time observation of chemical reactions in solution

- **ABSTRACT**

Nanocyrstals are widely studied for their physical properties and utilized in biology, electronics, optics, and catalyst. However, most of nanocrystal synthesis and their uses are developed empirically with a limited mechanistic understanding. It is mainly because of their size and heterogeneity in structures and physical properties which cannot be easily accessible by conventional analytical methods. Here, we introduce direct observations of the growth and resulting 3D atomic structures of individual nanocrystals observed by using liquid phase transmission electron microscopy (LTEM). Liquid phase has been introduced recently for high resolution in situ study of chemical reactions occurring in liquid. It allows high spatial and temporal resolution capabilities to studying materials' reactions that occur in liquid phase by using thin window materials and micro-fabrication techniques. Fabrication methods of making liquid cells with different types of electron beam transparent materials will be introduced. Our study using LTEM unveils heterogeneity of growth mechanism of individual nanocrystals and critical steps during growth that incorporate non-classical pathways. Following growth trajectories of individual metal nanocrystals, classical growth composed of nucleation and growth takes place concurrently with non-classical growth based on multiple coalescence events of small clusters in the same batch of the reaction while resulting averaged size and shape of nanocrystals are focused. To understand realistic structures of resulting nanocrystals directly in the solution, we develop 3D SINGLE which can be used to reconstruct 3D atomic arrangements composing individual nanocrystals. We develop 3D SINGLE by using a combination of high-resolution LTEM, aberration-corrected TEM, and ab initio structure reconstruction algorithm2. Observation of structures of solution-grown nanoparticle at 3D atomic resolution elucidates that nanoparticles find the local free energy minimum during growth trajectories composed of multiple coalescence events. 3D structures also expose details of internal and surface morphologies of individual nanoparticles and heterogeneity between them which cannot be obtained other structure analysis tools currently available. Following their motions and interactions in solution, formation mechanism of the 2D superlattice of nanocrystals is also elucidated in a single particle resolution. Direct observation of nanocrystal motions when conjugated with biological systems is also presented along with an introduction of the methodological development that enables aforementioned studies.

- **DATE AND VENUE**
  January 16, 2018 (Tuesday, 5:00 - 6:00 pm)
  Seminar Room 116, KU R&D Center

- **LANGUAGE**
  Korean

- **INVITED BY**
  Prof. Kyungwon Kwak

*If you want to have dinner with Prof. Jungwon Park, please contact Prof. Kyungwon Kwak (kkwak@korea.ac.kr).