

Formation, transformation, and biogeochemical processes of mineral nanocrystals in Earth's surface environment

Conveners: Juan Liu (Peking University, China), Xin Zhang (Pacific Northwest National Laboratory, USA), Keisuke Fukushi (Kanazawa University, Japan)

Mineral nanocrystals are ubiquitous on Earth and exhibit a diversity of physical and chemical properties that are dependent on particle size and shape. In the past two decades, numerous studies have been conducted to investigate how mineral nanocrystals influence the Earth system, which significantly broaden and enrich our understanding on the role of minerals in the biogeochemical processes that shape Earth's surface environment. However, there are still big gaps in our knowledge of the distinct properties and behavior of mineral nanocrystals in the complex Earth system, mostly due to lacks of systematic size-resolved thermodynamic data and analytical tools for minerals at the nanoscale. Like the rock and water cycles of Earth, the cycle of mineral nanocrystals, i.e. the cycle among minerals nanocrystals, their precursors, and the Earth components that they participate, is important for us to understand how Earth works as a whole system. The objective of this session is to provide a platform for interdisciplinary researchers from mineralogy, biogeochemistry, geomicrobiology, computational chemistry and material sciences to share their understanding the unique structures, properties, reactivities, and transformation of mineral nanocrystals in Earth's surface environment, to encourage discussion and interdisciplinary collaboration on a variety of biogeochemical processes involving mineral nanocrystals, as well as to facilitate exchanging ideas about advanced analytical and computational methods for studying properties and interfacial reactions of mineral nanocrystals. The topics that would be covered in this session are, but are not limited to:

- Nucleation and crystallization of mineral nanocrystals
- Size-dependent properties of mineral nanocrystals
- Molecular mechanism and pathway of transformation of metastable mineral nanocrystals
- Biomineralization
- Microbially mediated dissolution/precipitation of mineral nanocrystals
- Interactions at the interface between microorganisms and mineral nanocrystals
- In situ microscopic and spectroscopic techniques applied to interfacial processes of mineral nanocrystals
- Computational modeling and simulation on crystallization, dissolution, and transformation of mineral nanocrystals