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Nano-mineralogy investigations of geo-materials and synthetic analogous phases

Abstract

"*In-depth study of nano-Geology (nano-Earth Sciences) will inevitably bring a new understanding of geology*" (Hochella, 2002). Since professor Hochella from Virginia Tech wrote these words in one of his papers, many discoveries and technological progress have been made in nanosciences and equipment for nanoscale investigations. Nowadays, nanotechnologies are revolutionizing our world and lives: from medicine to communication, from energy to transportation, there is no scientific discovery or technical progress where the nanosciences are not involved directly or indirectly. Nevertheless, in Earth Sciences, the nanotechnology revolution has not yet touched all the disciplines; the Nano-Geology is indeed at an embryonic phase or limited to some peculiarities and applications of mineralogy, crystallography, or rock deformation.

To address this challenge, transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM) represent the most powerful techniques to perform imaging, diffraction, structural, and chemical analyses of materials, able to access unprecedented information down to even the atomic scale. In this direction, by performing TEM and STEM Nano-Mineralogy investigations and "Nano-Petrology" experiments, we can shed light on complex processes and reactions, such as those involved in rock deformation, in the physicochemical transformation of phases at high temperature and high pressure, and improve the understanding of materials for advanced technological applications.

In this context, it is apparent how the Nano-Mineralogy acts as a backbone for the Geology disciplines and as a bridge to Material Sciences and Material Engineering.

Reference

Hochella, M.F.JR., 2002. Nanoscience and technology: the next revolution in the Earth sciences. Earth and Planetary Science Letters, 203: 593-605