Fate and impacts of nano-CeO_2 in an activated sludge bioreactor

L. BARTON [1], M.AUFFAN [2], A.MAISON[2], C.SANTAELLA [3], L.OLIVI[4], N.ROCHE [5], J.Y.BOTTERO[2] AND M.WIESNER[1]

[1]Duke University, Durham, NC: leb40@duke.edu, wiesner@duke.edu
[2]CEREGE, France: auffan@cerege.fr, maison@cerege.fr, bottero@cerege.fr
[3]LEMIRE, CEA Cadarache, France: catherine.santaella@cea.fr
[4]ELETTRA Synchrtron, Italy: luca.olivi@elettra.trieste.it
[5]University Aix-Marseille, France: nicolas.roche@univ-amu.fr

Widespread use of Engineered Nanomaterials (ENMs) in a myriad of consumer products and technologies has lead to release of ENMs to the environment. A likely first route of environmental exposure of ENMs is thrugh the waste stream. Within wastewater treatment plants (WWTPs) ENMs undergo transport and transformation processes different from traditional organic contaminants. Understanding ENM-specific fate and transport is thus a critical void in current nanomaterial research.

In this study, we tracked the mobility and transformations of a common ENM, CeO_2 to determine releastic concentrations and the nature of the ENMs released from WWTPs in solid and effluent. An aerobic bioreactor seeded with sampled activated sludge was dosed with pristine and citrate coated CeO_2 chronically at enviornmentally relevant concentrations for a six week period. Two samples of CeO_2 were employed to observe the impact of surface chemistry on fate. During the lifetime of the reactor, affinity of the ENM for the solid versus liquid phase was measured and it was observed that > 90% of the added CeO_2 associated with the solid phase regardless of the surface coating. In addition, Ce speciation was monitored with XANES to explore the CeO_2 transformations. It was found that after 5 weeks in the reactor environment, strong reduction of the Ce(IV) in the ENM to Ce(III) occurred. Reduced Ce(III) was only measured in association with the solid phase indicating the key role of the microbial communities in promoting this reduction. In addition, it was seen that the citrate coating altered the kinetics of this reduction by preventing it until consumption of the coating by the bacteria. Determination of the interaction with the biomass and nature of the Ce(III) complexes is ongoing. Studies such as these can help inform the modeling community attempting to predict exposure and risk of ENMs released to the enviornment.

New interpretation of kinematics and morphogenesis of block structures of the Black Sea-central transcaucasian terrane

LEVAN BASHELEISHVILI

[1]Javakhishvili Tbilisi State University A.Djanelidze geology institute, Georgia, levanbash@yahoo.com

Modern structure of the Black Sea-Central Transcaucasian Terrane is mainly conditioned both by meridional and latitudinal fault systems. They encompass different depth of the Earth's crust crystalline basement. They as a whole make a mosaic-block pattern. The analysis of lithofacies and thicknesses of sedimentary cover sometimes establishes their autonomous and inverse nature of development as well as differentiated kinematics. The research data enables to make the following conclusions: The Caucasian molasse depression (within the territory of Georgia) is divided into eastern and western subsiding zones by the Dzirula (crystalline basement) salient; they are also divided by faults into separate restricted blocks. Westwards and eastwards of the central uplift zone, along the faults is outlined a gradual "stepwise" submergence and tilting of blocks of the crystalline substrate. In the modern literature the analogous structures are known as the so called "tilt" blocks and kinematically they are related to tensile strains.

Thus, in contemporary structure of the pre-Alpine crystalline basement of the South Caucasian molassics depression (along the latitudinal profile) is marked the existence of tension structure mainly in condition of stepped-inclined blocks, which subsequently turn into the so-called listric faults. The appearance of this one is bound up, on the one hand, with uplift of the mantle masses in some parts of the region and on the other hand, with advance of the Arabian plate to the north and connected with them lateral squeezing out of masses both to the west and the east especially at the late-orogenic (collision) stage of development.

DOI:10.1180/minmag.2013.077.5.2
www.minersoc.org