Poster Presentations

[MS24-P27] Old materials in the nanoworld: cases of shape and dimensionality control
Santiago García-Granda

Department of Physical and Analytical Chemistry, University of Oviedo-CINN, Oviedo, Spain
E-mail: sgg@uniovi.es

The versatility of phosphate materials concerning microscopic dimensionality and nanostructural shape is shown throughout two recent examples. Trialkylammonium-titanium(IV) phosphate nanomaterials with different shape, size and crystallinity are reported. These nanomaterials have been prepared by using microemulsion-mediated solvothermal methods. Both morphology and structure are controllable, and this simple synthesis-route will be used to prepare whisker-, rod-, platelet-like and tubular hybrid nanomaterials [1,2]. It was found that the reaction temperature, concentration of reagents and molar ratio of the reactants have significant effect on the structure, shape and size of the nanocrystals formed. Experimental results indicate that the synthesis of TAA/TiP metastable phases can be controlled, and we are making efforts in this way. NH$_2$Zn$_2$(PO$_4$)(HPO$_4$) (1) two-dimensional zinc phosphate, via ammonia vapor interaction at room temperature, transform to NH$_2$Zn(NH$_3$)PO$_4$ (2) one-dimensional novel compound. By partial ammonia desorption (outgassing at room temperature or by soft thermal treatment) 2 transform to NH$_4$ZnPO$_4$ (3) with a well-known ABW-zeolitic topology. The crystal structure of 1 was refined using single-crystal neutron diffraction data, while that the crystal structure of 2 was solved ab initio using synchrotron powder X-ray diffraction. The structure of three compounds include extra-framework ammonium cations to the 4-fold coordinated zinc (ZnO$_4$ tetrahedra for 1 and 3, and ZnO$_3$N tetrahedra for 2) and phosphorus (PO$_4$ tetrahedra) with bi-, mono-or three-dimensional linkages, respectively for 1, 2 or 3. The mono-dimensional order occurs with the formation of a unusual link between ammonia molecules and zinc atoms. In our knowledge, the process described here constitutes the first example of dimensionality change in solid phase promoted by a solid-gas interaction at room temperature [3-6].

Acknowledgements: Financial support from Ministerio de Economía y Competitividad de España (MAT2010-15094, Factoría de Cristalización – Consolider Ingenio 2010) and FEDER.

Keywords: titanium; zinc; phosphate; nanoshape; dimensionality; ammonia.