

m26.p06

## New open-framework germanates with different types of inorganic molecular clusters

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**Keywords:** germanates, open-framework, zeolites

A series of open-framework germanates synthesized at Stockholm University, denoted as SU-n, will be presented. They include pure germanates as SU-44, the recently published crystalline SU-M [1] and an aluminogermanate SU-46.

All these germanates were prepared by hydrothermal synthesis from a solution consisting of germanium dioxide and an organic amine as template, using water as solvent. In most cases hydrofluoric acid was added as a mineralizer. The resulting solution was transferred to a teflon-lined autoclave and heated to temperatures between 160-170°C for one or two weeks.

Single crystal X-ray diffraction data for both SU-M and SU-46 were collected at 100 K using graphite-monochromatized Mo K<sub>α</sub> radiation. For needle-like crystals of SU-44, single crystal X-ray diffraction data were collected at 293 K using a synchrotron radiation at the beamline I711, Max-lab, Lund, Sweden. The structure solution and refinement were carried out using the interface WinGX [2] with the software SHELX-97. SU-46 is a three-dimensional structure with a new zeolite topology. It contains 2D intersecting 8-ring channels. Due to a tendency for twinning it has been difficult to determine the space group, apply absorption correction and find template positions.

SU-M is built from a single type of cluster Ge<sub>10</sub>O<sub>24</sub>(F,OH)<sub>3</sub> (denoted Ge<sub>10</sub>). The clusters are connected in such a way that they lie on a gyroidal minimal surface with fully ordered crystalline walls [1].

When the temperature for the synthesis of SU-M is raised, SU-44 was then synthesized. Instead of the Ge<sub>10</sub>-clusters in SU-M, SU-44 contains two different clusters, Ge<sub>7</sub>O<sub>17</sub>(F,OH)<sub>2</sub> (denoted Ge<sub>7</sub>) and Ge<sub>9</sub>O<sub>22</sub>(F,OH)<sub>4</sub> (denoted Ge<sub>9</sub>). Two different clusters in the same germanate structure has not previously been reported in the literature.

Acknowledgement

This project is supported by the Swedish Research Council.

[1] X.D. Zou, T. Conradsson, M. Klingstedt, M.S. Dadachov & M. O'Keeffe, *Nature*, 437 (2005) 716-718.

[2] L. J. Farrugia, *J. Appl. Cryst.* 32 (1999), 837-838.

m26.p07

## Novel propeller-like phosphorus containing compounds

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**Keywords:** phosphorus compounds, X-ray analysis, heterocycles

Molecular and crystal structures of novel propeller-like phosphorus containing compounds have been studied by X-Ray analysis. The molecule of 1-phenyl-3,3,10,10-tetrakis(triphenyl)-6,7-benzo-1-phospha-2,3,8,9-tetraoxa-tricyclo[3,3,0,2]-dec-6-ene is a first molecule of such type. The angles between the vanes of propeller are approximately 60 degrees. Benzene ring, bounded to phosphorus atom, is deviated from axis of propeller on 8 degrees. It is perpendicular to unsaturated cycle. In crystal of this compound there are no classical hydrogen bonds. But short contacts of F..F-type and O..F-type result in formation of cylindrical supramolecular ensembles with "fluorine channels" along *0b* axis. The crystal packing is stabilized by  $\pi$ - $\pi$ -interactions between aromatic ring of tricyclic system. The packing coefficient and solvent accessible potential area in crystal were also analyzed.

This work supported by Russian Foundation for Basic Research (grants N 05-03-33008 and N 04-03-32156).

