

**MS13-1-20 New layered titanate,  $\text{NaTi}_2\text{O}_3(\text{OH})_3$ , obtained in hydrothermal environments at gigapascal pressures #MS13-1-20**A. Gordeeva<sup>1</sup>, M. Antlauf<sup>2</sup>, O. Andersson<sup>2</sup>, U. Häussermann<sup>1</sup><sup>1</sup>Stockholm University - Stockholm (Sweden), <sup>2</sup>Umeå University - Umeå (Sweden)**Abstract**

$\text{TiO}_2$ -based materials are widely used in a variety of applications, such as photocatalysis, lithium-ion batteries and etc., due to their peculiar chemical and physical properties<sup>1</sup>. Since Kasuga et. al.<sup>2</sup> for the first time synthesized long uniform titanate nanotubes in hydrothermal conditions the interest in the method and its potential use for the development of titanates with novel morphologies and/or structures has only been increasing. Despite that, only subcritical hydrothermal conditions have been studied, with pressures ( $p$ ) and temperatures ( $T$ ) below the critical point (cp) of water ( $T_{\text{cp}} = 374\text{ °C}$  and  $p_{\text{cp}} = 22.1\text{ MPa}$ ). In this work we are extending the synthesis to deep supercritical hydrothermal conditions in the range still accessible on industrial scale ( $T = 25 - 300\text{ °C}$  and  $p = 0.1 - 3\text{ GPa}$ ). Such conditions are known<sup>3</sup> to allow access to kinetically favoured phases and new morphologies.

Here we present new sodium hydroxo titanate,  $\text{NaTi}_2\text{O}_3(\text{OH})_3$ , obtained by the hydrothermal conversion of amorphous titania and aqueous sodium hydroxide mixture at 1.3 – 1.5 GPa and 170 – 190 °C. Its crystal structure was characterized from powder X-ray and continuous rotational electron diffraction data (space group  $C2/m$  (No. 12),  $a = 5.2685(1)\text{ Å}$ ,  $b = 9.1256(2)\text{ Å}$ ,  $c = 9.4581(4)\text{ Å}$ ,  $\beta = 90.0503(9)\text{ °}$ ). The monoclinic structure constitutes layers of edge-condensed  $\text{TiO}_6$  octahedra, one quarter of which is missing and replaced by basal triangles of  $\text{NaO}_6$  octahedra from the adjacent layers. The channel-like layered structure and its stability in strongly acidic and alkaline environments promise a wide use of the novel sodium hydroxo titanate in adsorbent applications, such as the removal of organic molecules and radioactive toxic metal ions from water.

**References**

1. Zhang Y. et al. RSC Adv., 2015, 5, 79479–79510.
2. Kasuga T. et al. Langmuir, 1998, 14, 3160–3163.
3. Spektor K. et al. Inorg. Chem.I, 2016, 55, 8048–8058.

Structure, SEM and TEM images of the new titanate

