

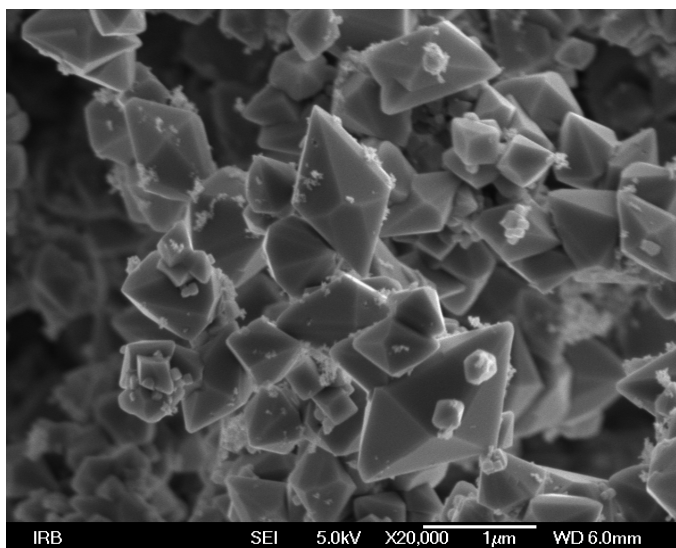
## Formation of Iron Oxides in a Highly Alkaline Medium in the Presence of Palladium Ions

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Iron oxides and oxyhydroxides are common compounds which are widespread in nature and possess properties suitable for a broad range of applications [1]. They are used as pigments (paints, coatings, rubber fillers, construction sealants, cosmetics, ceramic glaze, etc.), catalysts, materials for magnetic recording devices, abrasives, gas sensors, etc. For most of these applications it is very important that a particular iron oxide or oxyhydroxide material has specific characteristics which depend on its microstructural properties (particle size and shape, crystallinity, porosity, etc.). The presence of various additives in the precipitation system has an important influence on the properties of synthetic iron oxides.

The effect of the presence of palladium ions in a highly alkaline precipitation system on the formation of iron oxides was investigated using X-ray powder diffraction (XRD), Mössbauer and FT-IR spectroscopies, field emission scanning electron microscopy (FE-SEM) and energy dispersive X-ray spectroscopy (EDS). Acicular  $\alpha$ -FeOOH particles precipitated in a highly alkaline medium with the addition of tetramethylammonium hydroxide (TMAH) were used as reference material. Initial addition of palladium ions to that precipitation system had a major impact on the formation of iron oxide phases and their properties. In the presence of palladium ions, the initially formed  $\alpha$ -FeOOH has been transformed into  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> crystals in the form of hexagonal bipyramids (Fig. 1) via the dissolution-reprecipitation mechanism with a simultaneous formation of metallic palladium nanoparticles. These palladium nanoparticles acted as a catalyst for the reductive dissolution of  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> particles and the formation of Fe<sub>3</sub>O<sub>4</sub> crystals in the form of octahedrons. Increase in the initial concentration of palladium ions in the precipitation system accelerated the transformation process  $\alpha$ -FeOOH  $\rightarrow$   $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>  $\rightarrow$  Fe<sub>3</sub>O<sub>4</sub>.



**Fig. 1:**  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> crystals in the form of hexagonal bipyramids along with metallic palladium nanoparticles.

- [1] R.M. Cornell, U. Schwertmann, *The Iron Oxides, Structure, Properties, Reactions, Occurrence and Uses*, Wiley-VCH, Weinheim, 2003, pp. 516-517.
- [2] S. Krehula, S. Musić, *J. Mol. Struct.* 834 (2007) 154-161.