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Hydrothermal synthesis of hierarchical porous material in the system Fe-O-OH

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This project aims to create the hierarchical porous material of iron oxyhydroxide by a hydrothermal method. The idea is using schwertmannite as iron source, which is an iron (III) oxyhydroxysulfate with a somewhat variable composition and the general formula $Fe_8O_8(OH)_x(SO_4)_y \cdot nH_2O$ where $8 - x = 2y$ and $1.0 \leq y \leq 1.75$. Though schwertmannite can be synthesized by various biotic and abiotic methods, its structure cannot be clearly explained yet. The latest suggestion for the structure model is a defective akaganeite structure with broken channels and sulphate groups instead of chlorine. There should be amounts of defective sites at FeO_4OH_2 octahedral ribbons, yielding an open structure with high surface area.
While zeolites absorb cations, schwertmannite is classified in the group of anion-exchanger and also interesting as candidates for high active battery materials. In this regard, it is optimal for one single phase to have hierarchical pore system from micropores up to mesopores.
Based on disordered akaganeite structure of schwertmannite, we will perform synthesis with various bulky organic species such as Brij 58, cetylpyridinium chloride monohydrate, sodium salicylate and so on. Synthesis will be performed via hydrothermal routes. To determine the optimal condition of synthesis, a series of physical parameter, namely, the molar ratio of iron source and organic template, time and temperature, need to be considered. X-ray powder diffraction (XRD), chemical analysis, scanning electron microscopy will be measured to analyse the products.

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