TAILORING OF A HIERARCHICALLY STRUCTURED MATERIAL FROM DIATOMITE

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Based on a previous study (HÖLLEN et al., 2012), where diatomite was converted into zeolites via the formation of an intermediate phase we adapted the hydrothermal treatment process by decreasing the molarity of the Al-containing KOH solution from 1 M to 0.1 M to slow down the dissolution of diatoms and to prolong the period of metastability of the intermediate phase. This change of experimental parameters yielded after 1 d at 100°C a hierarchically structured material consisting of remaining diatoms with macropores of about 100 nm and newly formed nanoparticles of the intermediate phase. These x-ray amorphous particles consist of a potassium-aluminium-hydroxy-silicate, have a diameter of about 50 nm and are characterized by inner pores with a diameter of only few nm. The intermediate phase can remove heavy metal ions like Cu^{2+}, Pb^{2+} and Zn^{2+} very efficiently from aqueous solution. Considering that particulated matter acts as adsorbens for oxyanionic contaminants like AsO_4^{3-}, CrO_4^{2-} and MoO_4^{2-} which can be formed during leaching of alkaline wastes (CORNELIS et al., 2008), hierarchically structured materials which can remove dissolved and particulate contaminants simultaneously from aqueous solutions are highly promising.

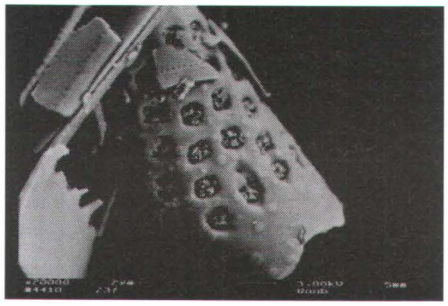

Figure 1. SEM-SE image of a hierarchically structured material, consisting of a macroporous diatom and nanoporous potassium-aluminium-hydroxosilicates growing in its pores.

CORNELIS, G., JOHNSON, C.A., VAN GERVEN, T VANDESCASTEELE, C. (2008): Applied Geochemistry, 23, 5, 955-976.

HÖLLEN, D., KLAMMER, D.; LETOFSKY-PAPST, I, DIETZEL, M. (2012): Journal of Material Science and Engineering A & B., 2, 10, 523-533.