

PREPARATION OF VERMICULITE PARTICLES FOR UTILIZATION IN CLAY/POLYMER NANOCOMPOSITES

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Layered silicates (phyllosilicates) represent important native clay materials, which improve stiffness, strength, toughness, and thermal stability of the polymer/layered silicate nanocomposites. Chemical modification is important for preparation of nanoclays particles to make them compatible (organophilic) with organic monomers and polymers. Nanoclays combined with monomers or polymers form nanocomposites. The best properties of polymer/clay nanocomposites are achieved when exfoliated phyllosilicate particles are homogeneously dispersed in polymer matrices. Especially suitable are 2:1 phyllosilicates with molecular water in the interlayer, because their exfoliation results from a spontaneous escape of the interlayer water. Vermiculite (VER) is abundant 2:1 phyllosilicate that is much cheaper compared to widely used montmorillonite, hectorite and saponite.

We decided to choose octadecylamine (ODA) with a long alkyl chain for intercalation of VER. The main goal of this intercalation is to achieve organophilization of VER and its exfoliation. Low-temperature intercalation of VER with ODA forms VER/ODA complex which consist of exfoliated vermiculite particles with the grafted nano-layers of ODA chains on the surface of micro-flakes [1].

We have studied two combining procedures for the exfoliation/delamination of VER particles:

- Exfoliation/delamination with ODA after previous treatment of VER particles with oxidizing agents [2, 3];
- Exfoliation/delamination of VER particles using intercalation with ODA and its subsequent micronization using jet mill.

Exfoliated/delaminated vermiculite was evaluated using X-ray powder diffraction (XRPD), scanning electron microscope (SEM), atomic force microscope (AFM) and structure was simulated using molecular modeling.

References:

- [1] Weiss Z., Valášková M., Křístková M., Čapková P. & Pospíšil M., *Clays and Clay Miner.*, **51** (2003) 555.
- [2] Weiss Z., Valášková M., Seidlerová J., Křístková-Šupová M., Šustai O. Matějka V. & Čapková P., *J. Nanosci. Nanotechnol.*, **3** (2006) 726.
- [3] Matějka V., Šupová-Křístková M., Kratošová G. & Valášková M., *J. Nanosci. Nanotechnol.*, **6**, (2006) 2484.

Figures:

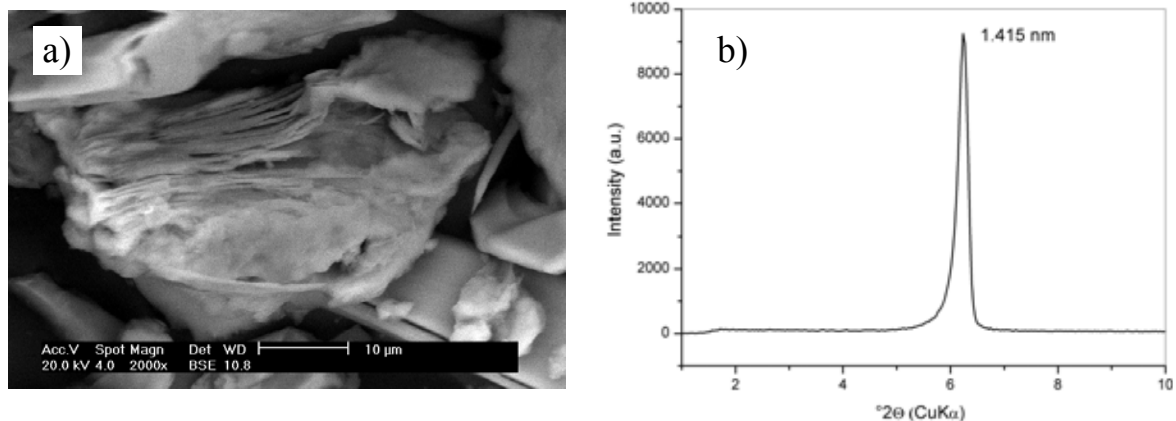


Figure 1. Untreated VER sample: a) SEM micrograph, b) XRPD pattern (part from 1 to 10 $^{\circ}$ 2θ)

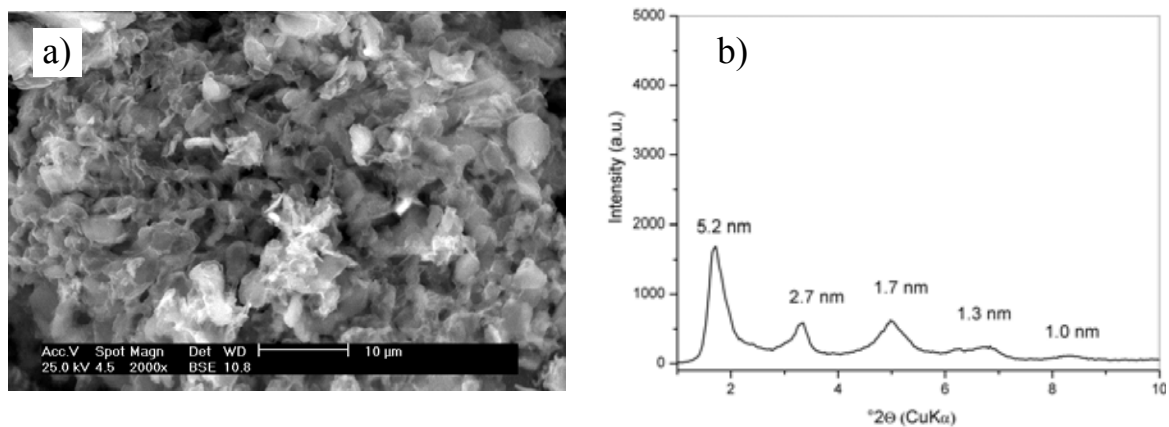


Figure 2. VER/ODA intercalates after jet milling: a) SEM micrograph, b) XRPD pattern (part from 1 to 10 $^{\circ}$ 2θ)