

SPONTANEOUS EXFOLIATION AND SELF-ASSEMBLY PHENOMENA IN POLYVINYLPIRROLIDONE/SYNTHETIC LAYERED SILICATE NANOCOMPOSITES

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Polyvinylpyrrolidone (PVP) and synthetic montmorillonite (MMT) were used to prepare nanocomposites via the solution intercalation method using water as a solvent. The structural properties of the PVP/MMT nanocomposites were investigated by using wide- and small-angle X-ray scattering (WAXS and SAXS) as well as transmission electron microscopy. The research revealed that at concentrations not exceeding 20 wt.% MMT exfoliates without a necessity of any mechanical treatment. The orientation process needs no external force like shearing or stretching. Orientational structure was investigated by 2D WAXS and 2D SAXS methods. Analysis of diffractograms recorded for samples oriented with edges to the primary beam revealed that silicates platelets were aligned parallel to the surface of polymer film (Fig. 1). From TEM images it can be concluded that nanocomposites of PVP/MMT with 5 wt.% of MMT are exfoliated and distance between montmorillonite platelets average 32 nm (Fig. 2).

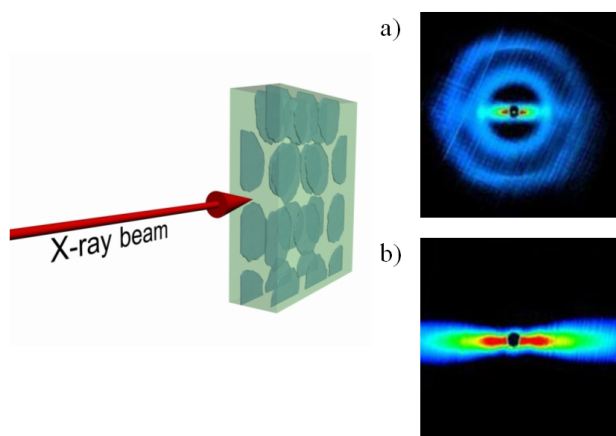


Figure 1. a) 2D WAXS and b) 2D SAXS patterns of PVP/MMT nanocomposites with 10 wt.% MMT.

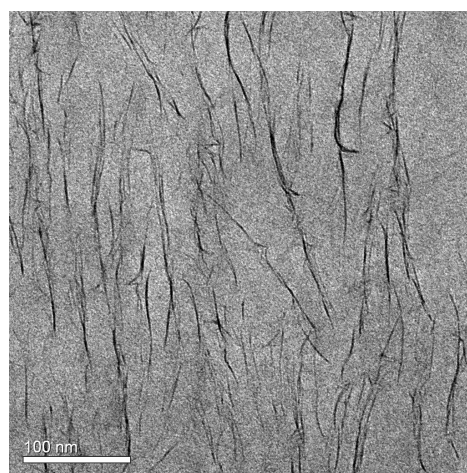


Figure 2. TEM image of PVP/MMT nanocomposite containing 5 wt. % of montmorillonite.

Similar observations were already made by Ogata *et al.* [1,2]. The main difference however is that the authors of the above mentioned article failed to obtain delaminated polymer clay system.

In addition to structural investigations thermal and optical properties of the nanocomposites were investigated. Differential Scanning Calorimetry indicated no significant changes in glass transition temperatures for obtained nanocomposites. TGA research revealed slight decreases of thermal stability in samples containing MMT when compared to pure polymer. UV-VIS transmittance spectra show lower transmittance for nanocomposites than for neat polyvinylpyrrolidone, however PVP/MMT blends still keep the good optical transparency.

References

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- [2] N. Ogata, G. Jimenez, H. Kawai, T. Ogihara, *J. Polym. Sci. B - Polym. Phys.* **35** (1997) 389–396.