Nanocomposites and nanomaterials

New methods of modification of montmorillonite for creation of polyurethaneacrylate nanocomposites

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Creation of polyurethane acrylate (PUA) - organoclay based nanocomposites with high performance properties is a real chance to improve the basic properties of initial PUA polymer matrix. The increase of the strength and durability of PUA based materials may be achieved by incorporation of organoclay nanoparticles into the polymer matrix.

In order to create polymer nanocomposites with high performance on the basis of polyurethaneacrylates (PUA) with montmorillonite (MMT), three methods of chemical modification of the layered silicate surface have been developed.

The first modification method is based on using two different functional modifiers (organophilic and reactive), the second method is based on modification with synthesized by us compound which contains urethane groups, and the third one in based on using synthesized by us modifier containing urethane and other reactive groups.

The exchange capacity of the MMT surface was determined by adsorption of indicator “methylene blue”. Intercalation of modifier into the interlayer space of MMT was confirmed by X-ray analysis; the content of the organic component in the modified MMT (MMT/M) was determined by thermogravimetric analysis. The resulting organoclay is purposed for the formation of nanostructured composites based on cross-linked polyurethane acrylates with improved physical and mechanical properties.

The obtained polyurethaneacrylate nanocomposites with different type MMT/M exhibit the increased in 1.6 - 2.6 times tensile strength as compared to the original polymer matrix.

WAXS method has proved an intercalation of modifier into MMT interlayer space (increased distance between layers after modification), as well as the total exfoliation of MMT in PUA matrix, characterized by the disappearance of the absorption peak which is responsible for layered structure.

New methods of MMT modification are universal and can be applied to MMT of various origins (deposits).