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# POSS-CONTAINING NANOCOMPOSITES BASED ON POLYURETHANE/POLY(HYDROXYPROPYL METHACRYLATE) POLYMER MATRIX: DYNAMIC MECHANICAL PROPERTIES AND MORPHOLOGY

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**Abstract.** A series of nanocomposites based on multicomponent polymer matrix consisting of polyurethane (PU) and poly(hydroxypropyl methacrylate) (PHPMA), and 1,2-propanediolisobutyl polyhedral oligomeric silsesquioxanes (POSS), used as functionalized nanofiller, have been synthesized. The effect of POSS content (0-10 % by weight ) on the dynamic mechanical properties (by DMA) and morphology (by SEM) have been investigated. The introduction of POSS into PU/PHPMA matrix was found results in increased (1.5 - 3 times) storage moduli of nanocomposites depend on amount of nanofiller. Investigation by SEM have shown that POSS-diol, introduced into the multicomponent polymer matrix acts as nanostructuring agent in the system. As a result, the nanocomposites with more ordered structure are formed leading to obtaining of materials with improved mechanical properties.

**Keywords:** polyurethane, poly(hydroxypropyl methacrylate), 1,2-propanediolisobutyl polyhedral oligomeric silsesquioxanes, nanocomposites, dynamic mechanical analysis, scanning electron microscopy

## 1. INTRODUCTION

Nanocomposites are a unique class of materials in which a little quantity of nanofillers can significantly improve their properties [1-5]. Polyurethanes (PUs) are often used as polymer matrices for nanocomposites preparation due to their wide variety of physical and chemical properties [6-9]. The incorporation of polyhedral oligomeric silsesquioxane (POSS) macromer into the polyurethane matrix was found could lead to improving of the permeability of gas transport [10], to increasing of the conduction and the permittivity [11]. The addition of POSS into the PU's polymers leads to enhancement of their thermal stability [12-13], also leads to improving of the mechanical properties [14-15] due to the reinforcement effect of the nanoparticles. The increasing of resistance to oxidation of the nanocomposites was also detected by scientists [14,16] due to incorporation of POSS into the systems. These favorable effects are evident mainly when the functionalized POSS particles are integrated into a polymer's chains via a chemical reaction.

In our previous investigation [17] the nanocomposites based on polyurethane matrix and 1,2-propandiolisobutyl-POSS (POSS), used as functionalized nanofiller, were created and analyzed. The presence of two reactive hydroxy groups in peripheral substituent's of POSS allow it to react with diisocyanates results in embedding of the POSS particles into the main polymer chain of the nanocomposites [18-20]. It was shown that incorporation of the POSS nanoparticles into PU matrix leads to the formation of more ordered structure. The presence of the 1,2-propandiolisobutyl-POSS nanoparticles in the PU matrix also significantly affect the thermal stability of the nanocomposites [17].

Meantime, of essential interest for the creation of the nanocomposites could be the using of the multicomponent polymer matrices obtained by the method of interpenetrating polymer

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