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POSS-POSS NANOSTRUCTURES FOR ENERGY ABSORPTION

Abstract

In the present investigation, we have synthesized a POSS–POSS nanostructured material using highly selective "click-ene" chemistry. "Click-ene" chemistry is a solvent/catalyst-free reaction between an azide and alkene functional group, making it highly controllable and economical. The unique hybrid behavior of POSS molecules and the ease of tailoring their organic groups make them optimal materials for synthesis of controlled nanostructures. POSS consists of a silica cage with eight functional groups, and using these we create a nanostructure that will act as both the rigid and compliant domain. This is the first study to date that reports on the use of "click-ene" chemistry to create such POSS-based nanostructures. One POSS molecule is functionalized with an alkene functional group and another with the azide functional group. Once the two POSS molecules have been prepared with the appropriate functional groups, they are brought to 125° C for 24 hours in a round-bottom flask. This forms a strong triazole-ring between the two POSS molecules and can be tuned to form different architectures. Based on the reaction environments, POSS–POSS architecture can create different types of shapes, such as the bead, star, lamellar, and spherical. These different orientations of architecture are synthesized based on the required applications. These unique architectures of nanostructures can be identified as metamaterials. These metamaterials are periodic structures that exhibit selective wave filtering behavior. These POSS-based metamaterials can be used in different types of applications such as in adhesives and fiber-coatings in order to reduce vibrations.