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RAMAN STUDIES ON SI/PS NANOCOMPOSITE

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Nano-sized particles spread in a polymer matrix improve a set of properties of polymers by influencing their structural characteristics. Besides the small size of the nanoparticles and narrow size distribution, the interfacial interaction also plays a vital role in the formation of the unique properties of the nanocomposite. The final features of the nanocomposite depend on the active properties of the dispersed phase. It is known that Si is one of the most common semiconductive materials which is widely used in different areas of electronics. However, the properties of nano silicon differ from bulk Si. From this perspective, investigation of the Si nanoparticle-based polymer nanocomposites is an actual issue for material science and all branches of technology where semiconductive materials are actively used.

Polystyrene and silicon-based nanocomposites were prepared by ex-situ method. The structure of the prepared samples was analyzed by scanning electron microscope and x-ray diffraction technique. Raman spectroscopy is used as one of the fast and nondestructive methods for Raman scattering study. In this study, Raman measurements were carried out at room temperature. It was shown that the peak wavelength of silicon shifts with the increase of the silicon concentration in the polymer matrix. This can be explained by the phonon confinement effect.

DESIGN AND DEVELOPMENT OF ADVANCED MULTICOMPONENT BULK METALLIC GLASSY ALLOYS FOR TECHNOLOGICAL APPLICATIONS

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The presentation will be an overview of the main research thrusts at the “Novel Alloys Design and Development Lab” (NOVALAB) of MetE-METU, and at "Novel Materials and Nanotechnology" Research Center of

Azerbaijan Technical University (AzTU) in the designing and development of advanced multicomponent bulk metallic glassy alloys for technological applications. Fundamental principles and main aspects of Computational Materials Science (CMS) for modeling and simulation based "alloy design" which has been developed over 30 years at our Labs, will be presented.

Bulk metallic glasses (BMG) show a unique combination of specific metallic and glassy properties and since most of these properties cannot be found in crystalline materials, the BMG are attractive for practical utilization as a new class of structural as well as functional materials. Bulk glass-forming ability (BGFA) of a melt is frequently evaluated in terms of the critical cooling rate for easy glass formation, which is the minimum possible cooling rate necessary to preserve amorphous structure of melt during solidification preventing nucleation and growth of any crystalline structure in the alloy systems. In spite of great efforts that have been concentrated on the analysis of bulk glass forming ability (BGFA) of various multicomponent alloy systems, the exact nature of the mechanism of BGFA has not been revealed and is largely empirical. Unlike previous approaches, this lecture will address the problem of integrating modeling, computer simulation and atomic level theory into a new coherent methodology of widespread applicability aimed at designing the content and structure of multicomponent alloy systems having high BGFA leading to easy glassy phase formation under conventional solidification conditions. Application of this new approach for the designing and utilization of advanced Fe-based multicomponent BMG with enhanced physico-chemical properties will be discussed.

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