

Vibrational dynamics of Sn in Sn/a-Si multilayers

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The structure and properties of Group IV elements are both interesting and important. Tin has two allotropic forms. Above 13.2 °C, it stabilizes in a tetragonal structure, called white or beta tin; at low temperature, it has the diamond structure and is called grey or alpha tin. It has been discovered that grey tin can be stabilized at room temperature in thin film form on appropriate substrate. In this study, Sn/a-Si multilayers with various bilayer thickness were made by vapor deposition. We applied a recently developed method called nuclear resonant inelastic X-ray scattering (NRIXS) to directly measure the phonon density of states (DOS) of ^{119}Sn in some of the samples made. The smallest tin layer thickness was 10 Å. With 0.8 meV energy resolution, we were able to show that the DOS for these multilayers is qualitatively different than those of either white or grey tin. The similarity to the DOS of amorphous Si is pointed out, and a theoretical explanation is attempted.