Size Distribution of Nano-Crystallites in Non-Crystalline Binary Alloys

YONG W. KIM, Lehigh University, ANDREW ABRAHAM, Moravian College, JERRY KIM, UCLA — The factors that affect thermophysical property determination for non-crystalline metallic alloys include non-uniformities in compositional and morphological property within a specimen. A series of measurements have shown that a specimen’s thermal history leads to a spatial profile of elemental composition that differ from one specimen to another for the same alloy. (See Y.W. Kim, Int. J. Thermophysics 28, 732 (2007), and references therein.) In order to develop a theoretical model for temperature dependence of thermophysical properties, we consider thermal dissociation of nano-crystallites within a randomly close-packed (RCP) medium. Once the size distribution of the nano-crystallites has been established at a given temperature, a set of coupled dissociation equations can be solved at all other temperatures. Transport properties can then be computed over a range of temperature. In this paper we present the size distribution of crystallites in a bed of RCP spheres. Two different size spheres are mixed at several compositions to simulate non-crystalline binary alloys in 2-D. The distribution is found to be peaked at a crystallite size specific to a given alloy composition. This work is support in part by the NSF-DMR(Metals).