Journal of Applied Physics
Volume 68, Issue 1, Pages 28-32, 1990
American Institute of Physics

Quantum−dot Size−distribution Analysis and Precipitation Stages in Semiconductor Doped Glasses

Liu, Li−Chi; Subhash H. Risbud

Abstract

The sequence of stages during precipitation of semiconductor (e.g., CdS, CdSe) clusters from supersaturated glasses exhibiting quantum−confinement effects was investigated. The rate of formation of nanometer−size ‘‘quantum dots’’ distributed in a continuous glass matrix is critically determined by the time and temperature of the heat treatment given to the quenched glasses. The entire precipitation process was analyzed in terms of several decomposition stages: nucleation, normal growth, coalescence of quantum dots, and devitrification of the glass matrix itself. Experimental data obtained by differential thermal analysis were utilized to identify the heat−treatment temperature range associated with the precipitation stages. The size distribution of CdSe quantum−dot clusters was analyzed using our transmission electron microscopy data. The data of Ekimov et al. [Solid State Commun. 56, 921 (1975)] was reduced to time−temperature master plots useful for precipitating quantum dots of a given size in glasses.