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Phase-transition behavior of Selenium confined in periodic mesoporous silica: an x-ray scattering study[1] KUANGMIN LI, CONGSHANG WAN, GANG CHEN, Ohio University — Confinement of semiconductors in nanoporous media provides a new opportunity to modify their physical properties such as electric conductivity, thermal conductivity, and phase transition temperatures. To understand the effect of nanoscale confinement on the melting behavior of selenium, we now conduct x-ray scattering experiments on selenium that are confined in periodic mesoporous silica (PMS). Hexagonal MCM-41 and SBA-15 with cylindrical pores (2 - 30 nm in diameter) are synthesized and utilized as the host for selenium, which is filled into the periodic pores by vapor phase condensation. The PMS are characterized by small-angle x-ray scattering, from which the pore size and the pore wall thickness are determined. Wide-angle x-ray scattering are used to measure the melting points of selenium confined in cylindrical pores of various widths. Relation between pore width and melting point of Se is established and compared with the Gibbs–Thomson theory. Our study provides fresh insights into the applicability of the Gibbs–Thomson theory to inorganic semiconductors confined in nanoporous media.

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