Abstract

Fine structure effects and phase transition of Xe nanocrystals in Si

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We report on an X-ray diffraction study performed on Xe agglomerates obtained by ion implantation in a Si matrix.
At low temperature, Xe nano-crystals were formed in Si with different average sizes according to the preparation procedure.
High resolution diffraction spectra were detected as a function of the temperature, in the range 15-300 K, showing evidence of fine structure effects in the growth mode of the Xe nanocrystals.
We report the first experimental observation of fcc crystalline agglomerates with a lattice parameter expanded by the epitaxial condensation on the Si cavities, whereas for small agglomerates randomly oriented evidence of a contracted lattice was found.
For these nanocrystals, a solid-to-liquid transition temperature, size dependent, was detected; above the transition temperature, a fluid phase was observed.
Neither overpressurized clusters were detected at any temperature, nor preferential binary size distribution as reported for a metal matrix.

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