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Raman spectroscopy of free-standing Ge nanocrystals I.D. SHARP, Q. XU, C.Y. LIAO, D.O. YI, D.C. CHRZAN, E.E. HALLER, UC Berkeley and LBNL, Berkeley, CA 94720, J.W. BEEMAN, J.W. AGER III, LBNL, Berkeley, CA 94720 — Ge nanocrystals, with an average diameter of 5 nm, are grown in a silica matrix. Free-standing nanocrystals are obtained by selectively etching the oxide. Embedded nanocrystals experience considerable compressive stress relative to the bulk. The Raman line position of free-standing nanocrystals is redshifted by $\sim$6 cm^{-1} relative to that of embedded nanocrystals, indicating relief of the compressive stress. Mixed surface/bulk vibrational modes between 125 and 250 cm^{-1} and surface modes below 125 cm^{-1} are observed by Raman spectroscopy on free-standing nanocrystals. These modes are not observed for the case of embedded nanocrystals. Exposed nanocrystals are stable under ambient atmospheric conditions after the formation of a thin, self-limiting native oxide layer. The effect of oxide layer thickness on the vibrational spectra of free-standing nanocrystals will be discussed. This work is supported in part by U.S. NSF Grant Nos. DMR-0109844 & EEC-0085569 and in part by U.S. DOE under Contract No. DE-AC03-76F00098.

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