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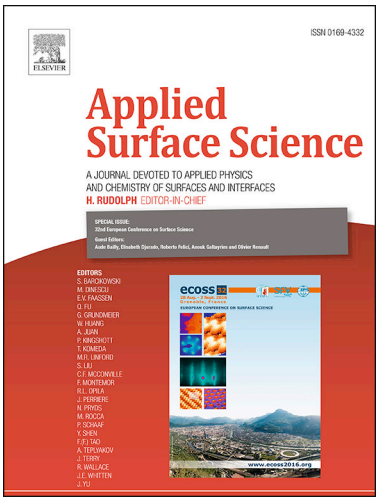

Full Length Article

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Analysis of Raman Scattering from Inclined GeSn/Ge Dual-Nanowire Heterostructure on Ge(111) Substrate

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Abstract:

In this paper, the Raman spectra of GeSn/Ge dual-nanowire heterostructure grown on Ge(111) substrate are systematically analyzed within the framework of anisotropic elasticity and lattice dynamical theory. Based on the experimental samples grown by molecular beam epitaxy, the partially covered dual nanowires standing along <110> direction are modeled and the structures present effective elastic strain relaxation due to the free surfaces. It is discovered the Raman shift of GeSn nanowire is mainly affected by the Sn content while the influences of strain becomes less important with the increase of thickness ratio. For Ge nanowire, the peaks of Raman spectra merely move with Sn content, but the spectra possess asymmetric broadening induced by the non-uniform strain distribution. The red-shift and reduction of intensity of the overall Raman spectra of the dual nanowires are observed when Sn content increases. Moreover, an analytic fitting expression for Raman peak position is obtained based on the numerical results and is expected to serve as a reference to predict the Sn content in GeSn/Ge dual-nanowire heterostructure.