Multiatom Interactions due to Misfit Strain in Coherent Heteroepitaxy

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In coherent heteroepitaxy, the relaxation of the elastic strain induced by the lattice size mismatch between the substrate and the overlayer leads to effective many-body interactions. The latter can be expanded into multiatom interactions including pair, triplet and higher atomic clusters. We show that the leading pair and trio interactions are always repulsive. If in addition to the elastic repulsion there exists some "chemical" attractive pair interaction, than the total effective pair interaction may become negative. If the repulsive trio interactions are of similar magnitude, the full interatomic interaction becomes fully or partially frustrated. This may lead to kinetic glassy phenomena, such as aging. This conclusion is substantiated by kinetic Monte Carlo simulation of a simple model.