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**Heterogeneous Nucleation of Quantum Dot Molecules in Heteroepitaxy**[1] HAO HU, HONGJUN GAO, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China, FENG LIU, Department of Materials Science and Engineering, University of Utah, Salt Lake City, UT 84112, USA — We develop a theoretical model to elucidate the heterogeneous nucleation of quantum dot molecules (QDMs) in heteroepitaxial growth of strained thin films. We show that critical size and energy barrier for nucleation of a QDM (two islands "strain bonded" by a pit in between) are reduced relative to those for isolated strained islands on flat surface. This is caused by an attractive strain-induced interaction between the islands and the pit. Consequently, islands prefer to heterogeneously nucleate next to a pit forming QDMs. For a fixed pit size, island-island interaction is shown to increase with increasing island size, giving rise to a self-limiting effect to prevent the island from further lateral growth (perpendicular to the pit edge), so that the islands elongate along the pit edge to form a "mature" structure of QDM. Our theory explains the most salient features of experimental results of QDMs.

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