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Comparison of Morphology Evolution of Ge(001) Homoepitaxial Films Grown by Pulsed Laser Deposition and Molecular Beam Epitaxy
B. SHIN, DEAS, Harvard Univ., J.P. LEONARD, Dept. of Mat. Sci. & Eng., Univ. of Pittsburgh, J.W. MCCAMY, DEAS, Harvard Univ., M.J. AZIZ, DEAS, Harvard Univ. — Using a dual MBE-PLD UHV chamber, we have conducted the first experiments under identical thermal, background, and surface preparation conditions to compare homoepitaxial growth morphology in Pulsed Laser Deposition (PLD) and Molecular Beam Epitaxy (MBE). We have studied Ge(001) homoepitaxy as a model system to compare these deposition techniques. In PLD, the laser fluence is varied to generate depositing species with high and low kinetic energy. We find that in PLD with low kinetic energy and in MBE, the film morphology evolves in a similar fashion: initially round-based mounds form, followed by pyramid-like mounds with edges of the square base along <100> directions; the film roughness and mound separation increase with film thickness. In PLD with high kinetic energy, well-defined pyramid-like mounds are not observed and the morphology rather resembles that of an ion-etched Ge(001) surface. The areal mound density is higher for PLD films than for MBE films grown at the same average growth rate and temperature. Furthermore, the dependence upon film thickness of roughness and mound separation differ for PLD and MBE. We discuss these results in terms of the similarities and differences between kinetic mechanisms expected to be operating in PLD and MBE.

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