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Thickness inhomogenities and growth mechanisms of GaP heteroepitaxy XIANG LIU, Department of Physics, North Carolina State University, INKYO KIM, DAVID ASPNES — We report comparative studies of the heteroepitaxy of GaP by organometallic chemical vapor deposition (OMCVD) using trimethylgallium (TMG) and phosphine (PH3) sources on (001) GaAs, thermally generated SiO2, (001) Si, and nanoscopically roughened Si surfaces. Inadvertent indirect but important data were also obtained from the polycrystalline GaP deposited on the Mo susceptor surrounding the 2 in. wafers. We found that the thicknesses of the deposited GaP films increases or decreases exponentially toward the edge of the wafers. This dependence is incompatible with the common explanation of gas-phase depletion of the precursors. Starting with the diffusion equation, we derive analytic expressions that describe the thickness variations in terms of the diffusion parameters, and evaluate the diffusion length quantitatively. We show that the cause is due to differences in chemical reactivities of the various surfaces, especially the different catalytic effects that they exert on PH3 decomposition. The results also show that different parts of the surface, including the susceptor, are in constant contact with each other during growth through gas-phase diffusion, and that deposition occurs via a precursor that involves both Ga and P. We propose a model for GaP growth based on the formation mechanism of this precursor.

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