

# HETEROEPITAXIAL PROCESSES AT LOW AND ELEVATED PRESSURES

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## Abstract

Based on design criteria established in preceding work for conditions of moderately elevated pressure ( $\leq 8$  bar) we have designed and evaluated a reactor for chemical vapor deposition (CVD) at high pressure ( $\leq 100$  bar). While at moderate pressure non-turbulent unidirectional forced channel flow past a heated substrate wafer can be realized, at high pressure, the flow is expected to become turbulent. Due to phase front distortions and variations in angle of incidence associated with density fluctuations and density gradients in the high pressure vapor phase in the vicinity of the hot substrate - the precision of methods of real-time optical process monitoring that employ polarized light, such as, p-polarized reflectance spectroscopy (PRS), is degraded. Above a critical pressure, features in the optical signals related to chemical kinetics and to the kinetics of heteroepitaxy, thus are no longer resolved. Therefore, experimentation at reduced gravity, which extends the pressure range of non-turbulent flow, and alternative robust methods of real-time optical process monitoring are considered. At very high pressures, where real-time process monitoring is severely curtailed, CVD processing must rely on predictions of numerical models - validated by experimentation at lower pressure/low gravity. Experimentation at high pressure is needed to access materials, properties and/or structures that otherwise cannot be realized.