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Virtual Sources in OMCVD Growth of ZnO: The importance of real-time diagnostics for process development E.J. ADLES, X. LIU, D.E. ASPNES, North Carolina State University — Growth of zinc oxide (ZnO) by organometallic chemical vapor deposition (OMCVD) is of high current interest because ZnO is nominally a plentiful, low-cost replacement for nitride devices, which rely on Ga. and In, and because CVD is a scalable process. However the extreme reactivity of the common zinc precursor, diethylzinc (DEZ), and the high volatility of ZnO itself make growth via CVD a challenging balance between deposition and sublimation. Using an OMCVD reactor with an integrated spectroscopic polarimeter, we have investigated growth of ZnO on sapphire in real time and have identified 3 factors that must be managed for successful growth. First, the immediate reaction of DEZ with the oxidizer species forms particles of ZnO and/or ZnO adducts, which we term the virtual source. These particles are large enough to scatter light, although the scatter vanishes at a well-defined distance above the growth surface as a result of particle size being reduced below the scattering threshold by sublimation. Second, a seed layer is necessary for growth to begin. Third, the volatility of ZnO at growth temperatures results in large exchange currents between the virtual source and the deposited material such that deposition is essentially reversible. A sequence of real-time spectra illustrates the formation of a seed layer, subsequent growth, and removal of deposited material by sublimation.

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