Optical diagnostics of surface kinetics during deposition processes

N. Dietz and D. Aspnes
Departments of Physics and Materials Science, North Carolina State University, Raleigh NC 27695-7919

Simulation, optimization, and control of processes involving organometallic precursors underlie a wide range of current and prospective technologies, especially when photon processing is involved. The extra dimensions of chemistry and photon processing can be expected to improve not only existing technologies but to lead to new types of devices requiring selective area deposition and/or low-temperature deposition of ordinarily incompatible materials to form device combinations such as chemical or biological sensors merged with Si integrated circuits.

The realization of these objectives requires capabilities not yet generally available: high intensity, tunable infrared sources for vibrational spectroscopy of weakly absorbing surface species to determine reaction pathways and kinetic parameters, and high intensity optical sources to influence the deposition processes themselves. The former capabilities provide necessary information for optimizing as well as understanding processes, while the latter provides a means by which this information can be put to practical use. With the rapid development of OMCVD capabilities and new methods of probing surface species, the time is right to take advantage of these capabilities. For example, these goals can be achieve by capitalizing the power of the CEBAF FEL to explore and develop the first viable means of performing reflectance surface spectroscopy in the infrared and also to perform proof-of-concept experiments to demonstrate large-area maskless deposition applicable to infrared detectors and other devices requiring large-area patterning. The development of large-area maskless processes will also gain momentum as high power laser light source at shorter wavelength become available, since new avenues for selective organometallic precursors decompositions can be explored.