

Structure and growth of vapor-deposited n-dotriacontane films studied by X-ray reflectivity

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Abstract

We have used synchrotron X-ray reflectivity measurements to investigate the structure of n-dotriacontane (n-C₃₂H₆₆ or C₃₂) films deposited from the vapor phase onto a SiO₂-coated Si(100) surface. Our primary motivation was to determine whether the structure and growth mode of these films differ from those deposited from solution on the same substrate. The vapor-deposited films had a thickness of ~50 Å thick as monitored in situ by high-resolution ellipsometry and were stable in air. Similar to the case of solution-deposited C₃₂ films, we find that film growth in vacuum begins with a nearly complete bilayer adjacent to the SiO₂ surface formed by C₃₂ molecules aligned with their long axis parallel to the interface followed by one or more partial layers of perpendicular molecules. These molecular layers coexist with bulk particles at higher coverages. Furthermore, after thermally cycling our vapor-deposited samples at atmospheric pressure above the bulk C₃₂ melting point, we find the structure of our films as a function of temperature to be consistent with a phase diagram inferred previously for similarly treated solution-deposited films. Our results resolve some of the discrepancies that Basu and Satija (Basu, S.; Satija, S. K. *Langmuir* 2007, 23, 8331) found between the structure of vapordeposited and solution-deposited films of intermediate-length alkanes at room temperature