

Abstract Submitted
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The effects of irreversible polymer adsorbed layers induced by CO₂ annealing on recrystallization/dewetting of ultrathin PEO films¹
LEVENT SENDOGDULAR, Stony Brook University, Stony Brook, New York 11794, MITSUNORI ASADA, Kurashiki Research Center, Kuraray Co., Kurashiki, Okayama 710-0801, Japan, NAISHENG JIANG, MAYA K. ENDOH, TADANORI KOGA, Stony Brook University, Stony Brook, New York 11794, BULENT AKGUN, SUSHIL SATIJA, Center for Neutron Research, NIST, Gaithersburg — The effects of CO₂ annealing on melting/recrystallization processes of spin-cast poly (ethylene oxide) (PEO) ultrathin films (20, 50 and 100 nm) prepared on Si substrates were investigated. In-situ neutron reflectivity results showed that all PEO thin films melt at a pressure as low as P=2.9MPa and at T=48°C which is below the bulk melting temperature (T_m). The films were then subjected to quick depressurization to atmospheric pressure, resulting in the non-equilibrium amorphous state of the saturating polymer with CO₂, and the recrystallization or dewetting process was induced during the continuous evaporation process at given temperatures below T_m . Detailed structural characterization using grazing incidence X-ray diffraction, atomic force microscopy, and polarized optical microscopy revealed two unique aspects of the CO₂-treated PEO films as compared to PEO thin films prepared via thermal annealing: the flat-on lamellar orientation, where the molecular chains stand normal to the film surface, is formed within the entire film regardless of the film thickness and the evaporation temperature; the dewetting kinetics for the 20 nm thick films is much slower than that of the thicker films. We will discuss the origins in the presentation.

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Levent Sendogdular
Stony Brook University, Stony Brook, New York 11794

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