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Temperature-Modulated Ellipsometry in Vacuum: A New Tool for Probing Glass Transition in Thin Supported Polymer Films MIKHAIL EFREMOV, SHAUHEEN SOOFI, ANNA KIYANOVA, FRANCO CERRINA, PAUL NEALEY, Department of Chemical and Biological Engineering, University of Wisconsin - Madison, Madison, WI 53706 — Observation of glass transition in thin polymer films is a good example of experimental challenges that measurements at the nanoscale may present. The standard technique in the field, ellipsometry, has been advanced by state-of-the-art approaches: measurements in vacuum and temperature modulation. Glass transition in 5 – 200 nm thick spin-cast polystyrene (PS) and poly(methyl methacrylate) (PMMA) films on silicon has been studied at 10^{-6} – 10^{-8} torr residual gas pressure, using both linear and modulated temperature scans [1, 2]. A well-defined glass transition in 5 nm thick PS and 10 nm thick PMMA films is observed. Factors that can alter glass transition temperature assignment will be discussed. Residual gas can affect data even at the pressures mentioned above [1]. An ionization gauge, the standard vacuum equipment, causes sample deterioration [1]. Temperature modulation effectively separates reversible glass transition from accompanying irreversible processes [2]. [1]. M. Yu. Efremov, S. S. Soofi, A. V. Kiyanova, C. J. Munoz, P. Burgardt, F. Cerrina, and P. F. Nealey, Rev. Sci. Instr., **79**, 043903 (2008). [2]. M. Yu. Efremov, A. V. Kiyanova, and P. F. Nealey, Macromolecules, **41**, 5978 (2008).

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