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Glass Transition of Polystyrene Thin Films on Silicon Wafer Measured by Dynamic Mechanical Analysis and Ellipsometry CATHERYN JACKSON, Dow Chemical, Core RD, Collegeville, PA 19426, TIAN LAN, Departments of Chem. and Bio. Eng. and Mat. Sci. and Eng., Northwestern University, Evanston, Illinois 60208, STEFAN CAPORALE, Dow Chemical, Electronic Materials, Marlborough, MA 01752, JOHN TORKELSON, Departments of Chem. and Bio. Eng. and Mat. Sci. and Eng., Northwestern University, Evanston, Illinois 60208 — Measuring the glass transition temperature, Tg, of polymer films in the thickness range of 20-500 nm is non-routine but commercially important for polymer films used in applications such as membranes and electronic circuit boards. Various specialized methods have been used or developed to determine Tg in thin films, including thermal ellipsometry and many others. Differential scanning calorimetry (DSC) is a more conventional method that has been used to measure Tg, but since the thin films must be scraped from the wafer, consolidation and annealing can occur in the pan and may negate effects due to film thickness. Here we report results for polystyrene (PS) spin coated on silicon wafers in the range of 20-500 nm using a benchtop dynamic mechanical analyzer (DMA) in the 3-point bending mode. For the DMA, the peak tan δ temperature is related to the polymer Tg and effects due to confinement as a function of film thickness are compared to literature values. We use thermal ellipsometry as a control method to measure film thickness and Tg in parallel. Low level additives present in commercial PS were observed to strongly affect the results for thin films and are described.

Catheryn Jackson
The Dow Chemical Company, Core R
D, Collegeville, PA 19426

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