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The Effect of Mechanical Deformation on the Glass Transition Temperature of Polyurea GILBERT LEE, WILLIS MOCK, JEFFRY FEDDERLY, EDWARD BALIZER, Naval Surface Warfare Center — The glass transition temperature (T_g) of a polyurea was found to be a function of prior mechanical strain and strain rate. Differential Scanning Calorimetry (DSC) measurements were performed on a polyurea following mechanical deformations ranging from low speed tensile testing to high-speed impact from a gas gun. The high-speed impact experiment was done by impacting a steel plate coated with 1/2 inch coating of polyurea with a pointed projectile. The highest strain rates and strain was localized at the center of the plate with the smallest at the circumference. Test specimens were taken from three locations on the coating: at the center free surface, center bounded to steel plate, and circumference (edge). The resulting T_g of the soft domain was found to be, on average, 8^oC higher at the free surface than at the bounded surface and 6^oC higher than at the circumference. For the low strain rate tensile specimens, the T_g increases with strain and reaches a maximum value at a strain of 3.6. These increases in the glass transition temperatures were interpreted as mixing of the hard and soft segments. The test specimens were subsequently thermally annealed at 100^oC. The T_g was found to be about 7^oC lower than the previous value. Small angle x-ray analysis has also shown the formation of fibrils in the high strain regions.

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