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Jamming transitions and high pressure response of a block co-polymer[1] RODNEY CLIFTON, Brown University, SCHOOL OF ENGINEERING, BROWN UNIVERSITY TEAM — Previous Pressure-Shear Plate Impact (PSPI) experiments on polyurea, an elastomeric block co-polymer, have shown the shearing resistance of polyurea to increase proportionately with increasing pressure, reaching a shearing resistance of 1 GPa at a pressure of 18 GPa. In an attempt to understand this remarkably high shearing resistance at high pressures, percolation theory has been introduced – likening the hard regions of the co-polymer to grains in a granular medium. A second order phase transformation, called a jamming transition, is hypothesized to occur at a critical reciprocal density as in the modeling of the effect of pressure on the shearing resistance of granular media. From percolation theory, the pressure-volume relation near the percolation threshold must be a power law centered at the percolation threshold (identified in the context of a block co-polymer as at a critical compressive strain). Application of this theory to a quasi-isentrope of polyurea leads to a 3-parameter model that fits the experimental quasi-isentrope, not just in the vicinity of a critical compressive strain but over nearly the entire range of strains for which data are available. Possible application of this approach to other materials is examined to assess whether or not percolation theory may be useful in a broader range of shock wave compression studies.

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