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Dynamical mechanical behavior of graphene and CNT materials under hypersonic projectile penetration

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DYNAMIC MECHANICAL BEHAVIOR OF BLOCK COPOLYMER MATERIALS AND MULTILAYER GRAPHENE MEMBRANES UNDER HYPERSONIC PROJECTILE PENETRATION

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We utilize laser pulses to send micro-projectiles at hypervelocity into various targets. Thick films of (a poly(styrene – b – dimethyl siloxane) (PS-PDMS) lamellar block copolymer – a model glassy-rubbery nanocomposite consisting of a self-assembled ordered arrangement of parallel periodic 20 nm thick layers of polystyrene and polydimethylsiloxane were impacted by 3 micron spheres of silica at velocities of 0.5 – 1.5 km/sec. We also use the silica spheres to study penetration through thin membranes of multilayer graphene. Soft projectiles, such as single crystal cubes of Ag are impacted onto hard impenetrable targets to observe the extensive plastic deformation of the projectile.

Our approach provides a versatile, rapid and efficient method to study nanoscale mechanical deformation and failure mechanisms in a variety of target and projectile materials at very high rates and large deformations on small samples.

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