



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Protective Equipment

Tensile Response and the Associated Post-Yield Heating of Polycarbonate

Polycarbonate (PC) is a thermoplastic polymer that can be easily molded and thermoformed. The mechanical properties of polymers are dependent upon two key factors: the rate of deformation and the material temperature. Researchers from USARL, sponsored by AMC and RDECOM, studied the tensile behavior of PC as a function of strain rate. DIC was used to measure localized plastic strain concentration, and a thermal (infrared) camera was used to measure the temperature change in the specimen at quasi-static ($\sim 10^{-3}/s$) and intermediate ($10^3/s$) strain rates. The material experienced non-uniform heating as high as 50–70°C, and had a significant rate-sensitive mechanical response. As the specimens yielded and plastically deformed, temperature in the specimen increased due to plastic work, with the largest temperature increase concentrated in the necked region of the specimen. The results of this study will enable the design and evaluation of transparent protection shields to mitigate injury during blast and impact loading.