Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

Shock response and spall behavior of polycarbonate and polymethyl methacrylate NOBUAKI KAWAI, TAKUYA SEKI, TSUTOMU MASHIMO, Kumamoto University — Polycarbonate and polymethyl methacrylate (PMMA) are major transparent polymer materials used in a wide range of applications. It is well known that these polymers show the strain-rate-dependence of mechanical properties. However, the mechanical behavior under the deformation with very high rates such as shock compression is still not well understood. In this study, plate-impact experiments were conducted on polycarbonate and PMMA to investigate their shock response and dynamic tensile (spall) behavior. The stress wave profiles propagated into samples were measured using PVDF piezoelectric film stress gauges embedded in samples. The spall strengths were determined by measuring free-surface-velocity profiles by means of the VISAR. Both measurements were performed simultaneously. The obtained stress-wave and free-surface profiles show that structural relaxation occur under shock-compressed state in both materials, but the tendencies of the relaxation in stress-strain plane are different each other even though they are typical amorphous polymer. In contrast, the spall strengths of both materials show same behavior that they are substantially constant under the shock loading up to about 2 GPa but decrease in the case of the shock loading above it.

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Date submitted: 22 Feb 2017 Electronic form version 1.4