DYNAMIC BEHAVIOR OF ALUMINUM FOAMS UNDER IMPACT AND SHOCK WAVES LOADS

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The dynamic behavior of aluminum foams under impact and shock wave loads has received increased attention, in recent years, due to the potential use of aluminum foams as energy absorbing shield layers against blast wave loads. Understanding the deformation mechanisms and the energy absorption capabilities of aluminum foams is one of the research goals of the Protective Technologies Research and Development Center at Ben Gurion University of the Negev.

In order to achieve this objective of structures protection with aluminum foams, one has to know their dynamic behavior. The following four types of tests were carried out, in order to obtain the mechanical properties of aluminum foams for a variety of strain rates:

1. Static loads using an Instron compressing machine.
2. Dynamic loads at a strain rate of 10^2 sec^{-1} using an Instron compressing machine.
3. Impact loads at a strain rate of 10 sec^{-1} using a 400-kg impact pendulum.
4. Shock wave loads at a strain rate of 10^3 sec^{-1} using a shock tube.

In the experiments the energy absorption was measured and graphs of the volumetric strain as function of the pressure and strain rate were obtained.

In addition, in the course of investigating the capability of aluminum foams to mitigate blast wave loads in field-tests, two new features of the aluminum foams were discovered. The first, a mechanical one, reveals a spallation process, and the second, a thermal one, reveals an ignition process.

A description of the experimental technique for measuring the dependence of the stress-strain curve on the strain rate and the above-mentioned new features will be presented.