Abstract Submitted
for the SHOCK05 Meeting of
The American Physical Society

Evidence of anisotropic wave propagation in laser shock-loaded quartz THIBAUT DE RESSEGUIER, PATRICK BERTERRETCHE, MARTINE HALLOUIN, Laboratoire de Combustion et de Detonique, UPR CNRS 9028, ENSMA, 1 ave. Clement Ader, 86961 Futuroscope Cedex, CHOCS DANS LES SOLIDES TEAM — The response of brittle single crystals to shock loading and their spallation under short pulsed loads are subjects of constant interest. Here, we show that the anisotropy of single crystal quartz has a major influence on stress wave propagation and spall fracture in that material. Post-test observations of laser shock-loaded samples cut out from single crystal quartz reveal spall damage in unexpected locations as well as a strong dependence of the observed behaviour on the direction of shock application versus crystal orientation. For instance, the propagation of a laser shock applied along the electrical (x) axis leads to a damaged zone of elliptical shape in the opposite free surface, with two spalls near its extremities. When a similar shock is applied along the mechanical (y) axis, spall damage consists in a single crater, with a strong lateral shift which indicates an oblique propagation of the stress pulse. Three-dimensional computations involving the elastic rigidity matrix of quartz have been performed to simulate those experiments. Despite the model limitations, they provide a good prediction of the observed positions, shapes and sizes of the spalled zones for the three crystallographic orientations.

Thibaut de Resseguier
Laboratoire de Combustion et de Detonique, UPR CNRS 9028
ENSMA, 1 ave. Clement Ader, 86961 Futuroscope Cedex

Date submitted: 09 Mar 2005 Electronic form version 1.4