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Ultrafast shock induced chemistry in hydrogen peroxide MICHAEL ARMSTRONG, JOSEPH ZAUG, NIR GOLDMAN, I-FENG KUO, JONATHAN CROWHURST, W. MICHAEL HOWARD, JEFFREY CARTER, MICHAELE KASHGARIAN, JOHN CHESSER, TROY BARBEE, SORIN BASTEA, Lawrence Livermore National Laboratory — Although strong compression waves have been used to study the equilibrium high pressure and temperature properties of materials for more than half a century, the study of ultrafast strain rate dependent material transformations, while promising, is only beginning to be fully explored. Shock waves can change the thermodynamic state of a material over a picosecond time scale, i.e. faster than the time scale of quasi-equilibrium reaction kinetics for many reactive systems. This fundamental property of shock compression suggests the possibility of selecting reaction paths via modulation of applied compression waves on a time scale that is faster than the time scale of reaction kinetics. Here we present experiments and thermochemical and molecular dynamics simulations on a model system, hydrogen peroxide, which demonstrate that the applied strain rate can be used alongside the pressure and temperature to control reactivity in bulk matter, thus enabling the exploration of otherwise inaccessible chemical reaction paths.

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