

UNIVERSITY OF RHODE ISLAND

Department of Chemistry

SEMINAR

Room 105 Beaupre

3:00 P.M., Monday, Oct. 22, 2018

Prof. Dana D. Dlott

William H. & Janet G. Lycan Professor

Chemical Sciences and Material Research Laboratory

University of Illinois at Urbana-Champaign

Urbana, IL

***"Watching Energetic Materials
through the Ultrafast Shock
Compression Microscope"***

HOST

Jimmie Oxley

Department of Chemistry

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Watching energetic materials through the ultrafast shock compression microscope

Dana D. Dlott, School of Chemical Sciences and Fredrick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, 600 S. Mathews Ave., Urbana, IL 61801, USA



We have developed a microscope that looks into materials and liquids as they are subjected to controlled high velocity impacts from laser-launched flyer plates. This convenient tabletop microscope set up allows us to perform well-characterized controlled shock experiments on tiny samples hundreds of shots per day. The flyer plates move a few kilometers per second, creating intense mechanical and thermal effects that can trigger new kinds of chemistry. One of these impacts can create pressures of 200,000 atm and temperatures of 4000K while compressing matter to half its density. In this talk, I will describe the shock compression microscope and the peripheral high-speed optical diagnostics that measure pressure, temperature, density and composition in real time. I will briefly visit a couple of applications ongoing in my lab such as studying the chemistry of extreme water, shock waves in biology and medicine and shock compression of molecular architectures designed to dissipate shock energy. Then I will discuss shock initiation and detonation of high explosives, including liquid explosives and plastic-bonded explosives. We can fabricate arrays of 1 mm diameter plastic-bonded explosive charges and push them to detonation while we watch. This shock compression microscope has many applications in chemistry, physics, materials science and biology and it lets us see right inside detonating high explosives with high time and space resolution.

Dana Dlott is the William H. and Janet G. Lycan Professor of Chemistry and a Professor of Materials Research at the University of Illinois. He received a bachelor's degree from Columbia University and a Ph.D. from Stanford University under the supervision of Prof. Michael Fayer, using ultrafast laser spectroscopy to study electronic energy transfer in molecular materials. After he joined the Chemistry Department at the University of Illinois (in 1979) he began a research program to study vibrational relaxation in solids. About 30 years ago he began to study shock waves in solids. Dlott is a Fellow of the American Physical Society, the Optical Society of America and the American Association for the Advancement of Science. He has been recognized with the ACS award in Experimental Physical Chemistry and the Lippincott prize of the OSA for his work in ultrafast vibrational spectroscopy. He is a former Chair of the APS Topical Group on Shock Compression in Condensed Matter and the author of 325 scientific publications.