# CHEMICAL DYNAMICS IN ENERGETIC MATERIALS INCORPORATING ALUMINUM NANOPARTICLES

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Aluminum nanoparticles are widely considered attractive as fuels due to the high heat of reaction associated with their oxidation, and the potential for fast reaction due to their small size. However, the reaction dynamics can also be strongly influenced by the passivation layer that coats the reactive metal surface. Typically, this takes the form of a naturally-occurring oxide shell on the nanoparticle, but other passivation schemes are now available. We have recently developed a sonochemical synthesis procedure to produce aluminum nanoparticles capped with oleic acid[a]. These nanoparticles have an aluminum metal core, some organic-provided oxide, and an organic shell. To investigate the effect of the passivation method on the chemical dynamics in energetic materials, we have studied samples consisting of a mixture of a metal nanoparticle fuel and an ammonium nitrate or ammonium perchlorate oxidizer. The metal fuel is either commercially available oxide-coated aluminum nanoparticles, or the oleic acid-capped nanoparticles. The energetic samples are ignited with an IR laser pulse. Following ignition, the chemical dynamics are studied using visible emission spectroscopy and mass spectrometry. Preliminary results suggest that our Al-oleic acid nanoparticles are able to react more rapidly than those that are conventionally passivated with a naturally-occurring oxide shell.

[a]K. A. S. Fernando, M. J. Smith, B. A. Harruff, W. K. Lewis, E. A. Guliants and C. E. Bunker *J. Phys. Chem. C* **113**, 500 (2009).