Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Enhanced Stress Relaxation and Reduced Cure Stress in Thermosets with Ferrocene-Based Crosslinkers[1] BRAD JONES, DAVID WHEELER, MARK STAVIG, HAYDEN BLACK, PATRICIA SAWYER, NICHOLAS GIRON, MATHIAS CELINA, TODD ALAM, Sandia National Laboratories — Organometallic sandwich compounds are characterized by facile isomerization among a variety of unique states. For example, ferrocene exhibits an extraordinarily low barrier to rotation of its cyclopentadienyl (Cp) ligands about the metal-Cp axis. We propose that this phenomenon can be exploited to enhance stress relaxation of polymers containing organometallic sandwich backbone moieties. Here, we describe the synthesis and characterization of several thermosets that employ ferrocene derivatives as crosslinkers. In particular, we compare a ferrocene diamine to several conventional diamines in the crosslinking of epoxy resin. Stress relaxation and dynamic mechanical analyses reveal that the ferrocene-based thermosets are distinguished from conventional thermosets by their capacity for physical relaxation. More importantly, these materials exhibit markedly different residual stress evolution during cure. For example, the cure stress in ferrocene-based thermosets drops precipitously with decreasing crosslink density. Our results highlight the unique role organometallic chemistry can play for stress management of thermosets and, more broadly, in manipulating their structure-property relationships.

[1]Sandia National Laboratories is a multi-program laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Company, for the US Department of Energy National Nuclear Security Administration under contract DE-AC04-94AL85000.

Brad Jones
Sandia National Laboratories

Date submitted: 02 Nov 2016 Electronic form version 1.4