
UNIVERSITY OF RHODE ISLAND
Department of Chemistry

SEMINAR

Room 234 Pastore Hall
3:00 p.m, Monday, April 25, 2016

Prof. Douglas H. Adamson

Dept. of Chemistry and Polymer Program
University of Connecticut
Storrs, CT

***"Graphene Nanocomposites by the
Thermodynamically Driven Exfoliation
of Pristine Graphite"***

HOST

Matt Kiesewetter
Department of Chemistry
401-874-2619

Graphene Nanocomposites by the Thermodynamically Driven Exfoliation of Pristine Graphite

Douglas H. Adamson

Department of Chemistry and Polymer Program, Institute of Materials Science, University of Connecticut, Storrs, CT 06269

Graphene is currently a hot topic, with broad interest driven by its electrical, mechanical, optical, and thermal properties. The use of graphene in commercial products, however, is lagging. For its use in composite materials, this is largely due to the challenge of exfoliating graphite into its individual graphene sheets. Past and current approaches include extended sonication in the presence of surfactants or the oxidation of graphite to form graphene oxide (GO). These approaches suffer from cost, degradation of composite properties, and environmental impact. All of these methods fight against thermodynamics, as the stacked arrangement of graphite is the most thermodynamically stable morphology. We have developed a fundamentally new approach to graphite exfoliation based on providing graphene with a new, low-energy morphology. We find that graphite will spontaneously spread at high-energy liquid/liquid interfaces, acting as a two-dimensional surfactant, lowering the interfacial energy between immiscible liquids. This surfactant behavior allows graphene to stabilize water-in-oil emulsions without additional surfactant or the oxidation or functionalization of the pristine graphene sheets. We use both experimental and computational approaches to help elucidate the mechanism of the graphene self-assembly, and by forming emulsions with monomer as the oil phase, create composite materials that are inexpensive, strong, porous, and electrically conductive. The tunable properties of the composites make them ideal candidates for applications in flexible electronics, sensors, filters, and porous electrodes.