 

*“Assembly and Disassembly of Layered Materials”*

Layered solids – which have strong bonds in two dimensions and weaker links in the third - are interesting building blocks for materials and devices because they potentially offer control over structure at the molecular level. Our research in this area began with the question of whether such compounds could be built up one layer at a time in controlled sequences on surfaces. This was possible by using either molecular precursors, in the case of metal phosphonates, or exfoliated sheets derived from lamellar microcrystals. Many layered oxides consist of negatively charged sheets interleaved by exchangeable cations. These oxides are particularly amenable to exfoliation (and to other topochemical reactions) by simple ion-exchange and acid-base reactions. Recently we have found that van der Waals solids such as graphite, hexagonal BN, and MoS2 can also be intercalated and exfoliated without incurring damage to the sheets by means of acid-base and redox reactions.

An interesting consequence of the layer-by-layer assembly processes is the overcompensation of the surface charge of nanosheets. This effect can be exploited to invert the layer charge of nanosheets (which is typically negative for sheets derived from early transition metal oxides) and enable the intercalation of negatively charged molecules and nanoparticles. While studying these reactions, we observed surprisingly strong bonding between late transition metal oxide nanoparticles and early transition metal oxide nanosheets. Calorimetric measurements and electronic structure calculations suggest that d-acid/base interactions – originally proposed by Leo Brewer to explain the anomalous stability of early-late transition metal alloys – contribute to the strength of nanoparticle/nanosheet covalent bonding. This finding helps us understand the strong metal support interaction (SMSI) in catalysis and provides a prescription for stabilizing catalytically active late transition metal nanoparticles.

2017

Tonight’s Program:

Science & Mathematics Learning Center, Auditorium 102

3:15 p.m. – Reception, SMLC Atrium

4:00 p.m. – Stephen Cabaniss, Dept. Chair and Professor

*Welcoming Remarks*

4:05 p.m. – Mark Peceny, Dean of the College Arts & Sciences

*Presentation of Award and Honorium*

4:10 p.m. – Martin Kirk, Professor of Chemistry

*Introduction of Prof. Mallouk*

4:15 p.m. – Prof. Thomas E. Mallouk “*Assembly and Disassembly of Layered Materials”*

**Presented by**

Prof. Thomas E. Mallouk

Pennsylvania State University

*“Assembly and Disassembly of*

*Layered Materials”*

Friday, October 20, 2017 at 4:00pm ,

SMLC 102

Reception in SMLC Atrium at 3:15pm

10th Annual

Riley O. Schaeffer

Endowed Lectureship

**UNM**  
[Street Address]  
[City], [State][Postal Code]

[Web Address]

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# Contributors:

This lectureship was established in 2008 in honor of Professor Riley Schaeffer through contributions from UNM faculty, past students of Professor Schaeffer at Indiana University and UNM and friends and external colleagues. Professor Schaeffer began his academic career at Iowa State University in 1952 as an Assistant Professor and he became Associate Professor with tenure in 1956. In 1958 he was recruited to join the faculty at Indiana University where he became Professor in 1962. After a highly productive career at IU, including a stint as departmental Chair, 1967-1972, he accepted the position of Dean of the College of Arts and Sciences at the University of Wyoming in 1976. He was recruited from that position to UNM where he served as Department of Chemistry Chairperson from 1981-1987 and he retired from UNM in 1992. Under his able leadership as Chair, Prof. Schaeffer guided the hiring and mentoring of a number of new faculty who have gone on to highly productive careers. Professor Schaeffer has also had a distinguished research record that includes critical discoveries in the synthesis, reactivity and structure analysis, via x-ray diffraction and NMR methods, of boron hydrides and carboranes. Professor Schaeffer received numerous honors, including a Guggenheim Fellowship; he is an AAAS Fellow and an Honorary Fellow of the Royal Society of Britain.

**Biography**

Thomas E. Mallouk is Evan Pugh Professor of Chemistry, Biochemistry and Molecular Biology, Physics, and Engineering Science and Mechanics at the Pennsylvania State University. His research focuses on the synthesis of inorganic materials and their application to solar energy conversion, catalysis and electrocatalysis, nano- and microscale motors, low dimensional physical phenomena, and environmental remediation. He is the author of over 400 publications, including a few good ones. He is an Associate Editor of the *Journal of the American Chemical Society* and Associate Director of the Penn State MRSEC, the *Center for Nanoscale Science*.

**Past Recipients:**

* 2008 – Professor, Carlos Bustamante, University of California-Berkeley
* 2009 - Professor, Larry G. Sneddon, University of Pennsylvania
* 2010 – Professor, Tobin J. Marks, Northwestern University
* 2011 – Professor, Harry B. Gray, California Institute of Technology
* 2012 – Professor, Peter R. Ogilby, Aarhus University
* 2013 - Professor, Edward I. Solomon, Stanford University
* 2014 – Professor, Marcetta Darensbourg, Texas A&M University
* 2015 – Professor, Thomas J. Meyer, University of North Carolina
* 2016 – Professor, John F. Hartwig, University of California, Berkeley

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