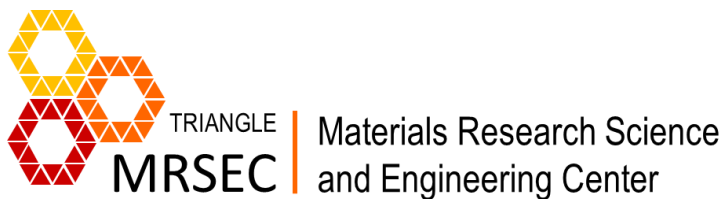


Nanoscale Assembly – A Collaborative Effort
Texas State University and the Research Triangle MRSEC

PREM Director's Meeting
May 20, 2013





The Partnership

PREM

Texas State University

Thrust 1: Multiscale colloid interfaces

Thrust 2: Regulatory control of polymer self-assembly into functional nanomaterials

Thrust 3: Propagation of knowledge through shared mentorship: The pipeline to success in STEM education

Research Triangle MRSEC

Duke, NC State, UNC, NC Central

Programmable Assembly of Soft Matter

IRG 1: Multicomponent colloidal assembly by comprehensive interaction design

IRG 2: Genetically encoded polymer syntax for programmable self-assembly

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James E. Shepard, Founder

TEXAS
STATE
UNIVERSITY
SAN MARCOS

The rising STAR of Texas



The Partnership

PREM

Research Triangle MRSEC



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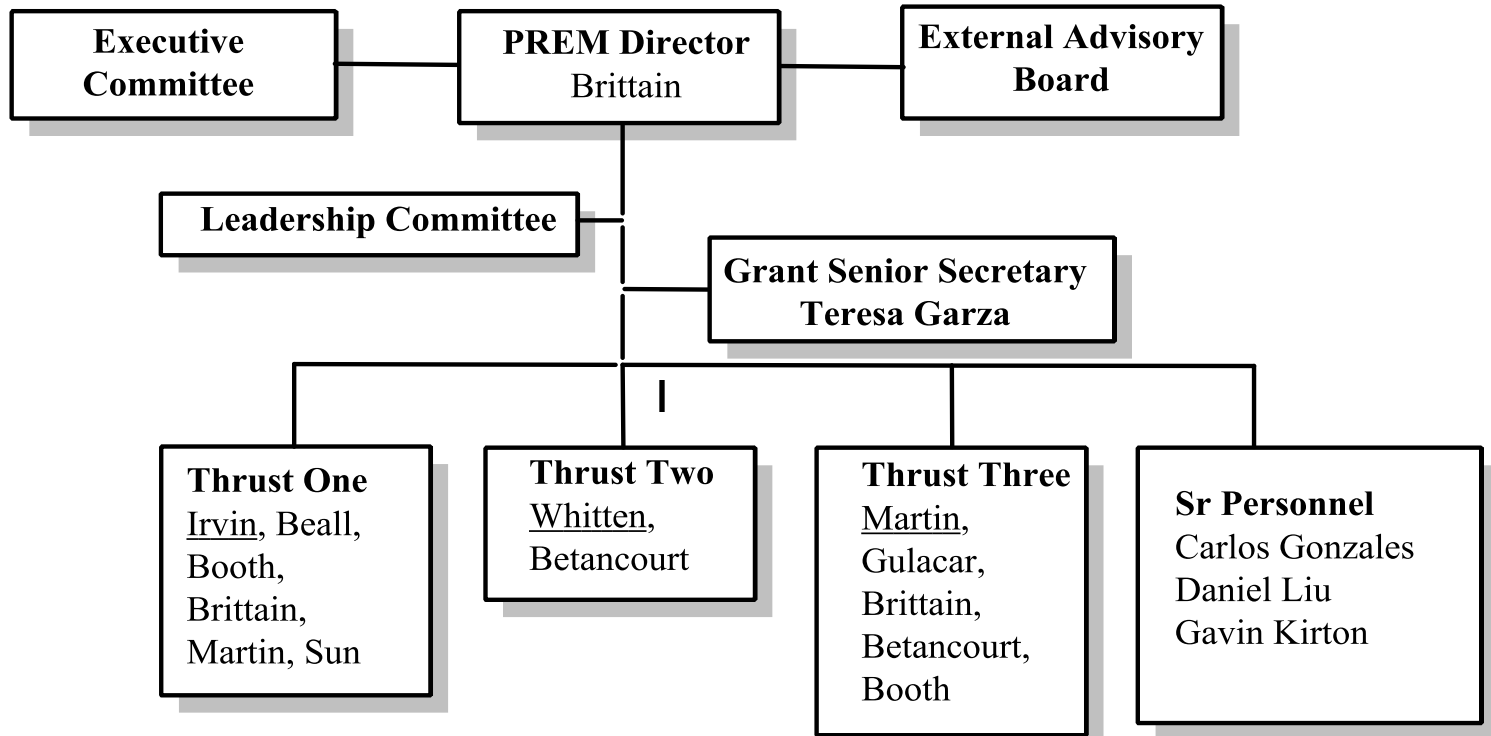
Kickoff Aug 2012



James E. Shepard, Founder

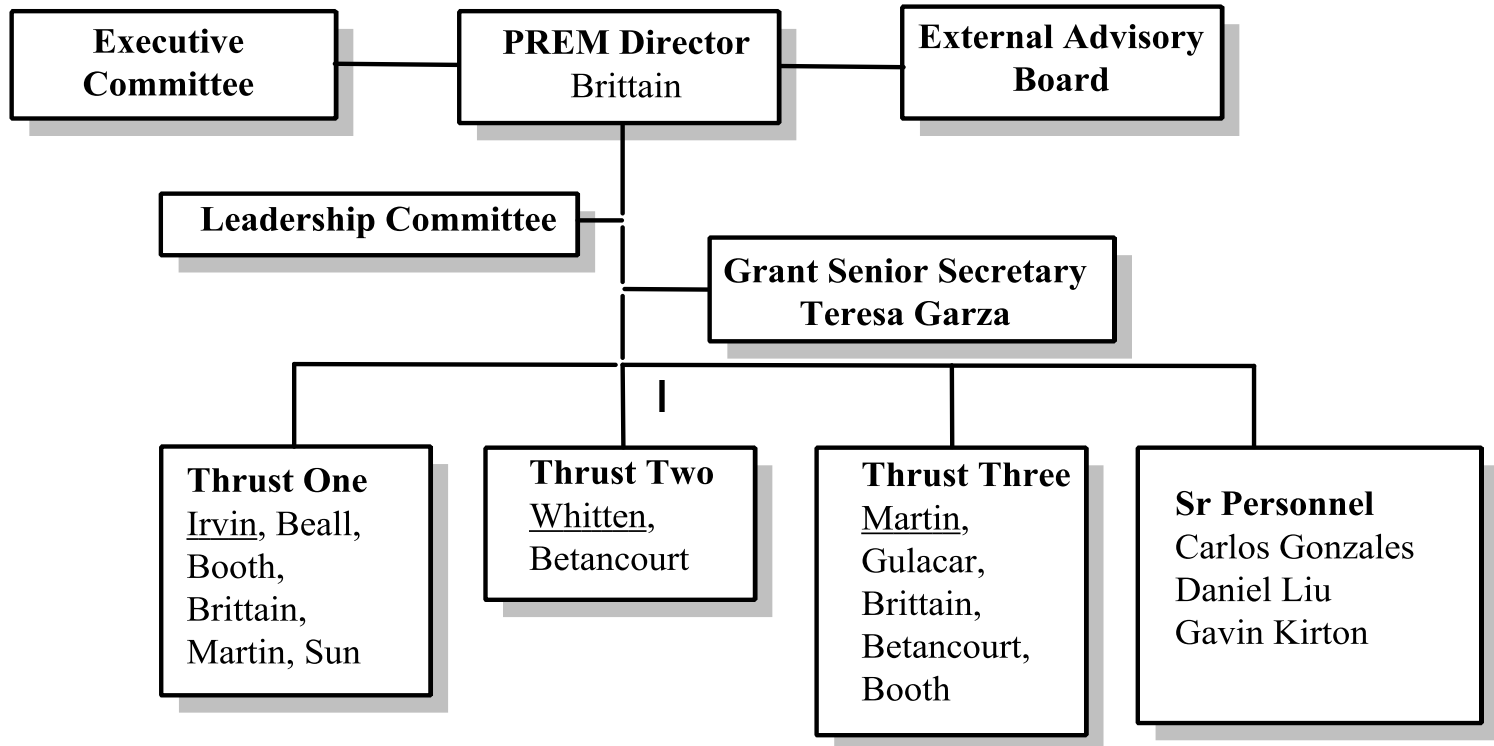


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10 graduate students
29 undergraduates





ry Iszard

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Texas State PREM Student Posters

Monodisperse Gold Nanoparticles Supported by Rice Husk Silica for Heterogeneous Catalysis Applications

Davontae L. Habbit, Yan Li, Raheim R. Turner, Haoran Chen, Luyi Sun
Department of Chemistry and Biochemistry, Texas State University

Organic Nanostructures for Photothermal Ablation

Travis Cantu,¹ Jennifer Irvin,^{1,2} and Tania Betancourt^{1,2}

¹Materials Science, Engineering, and Commercialization Program, Texas State University

²Department of Chemistry and Biochemistry, Texas State University

Soluble n-Doping Polymers

Leslie M. Wood,¹ Raddiete Ghion,² and Jennifer Irvin¹

¹ Department of Chemistry and Biochemistry, Texas State University

² Department of Biology, Texas State University

Edge Modification of MoS₂ for Self-Assembly Studies

Luis S. Isaac,¹ Benjamin R. Martin,¹ and Orlin Velez²

¹ Department of Chemistry and Biochemistry, Texas State University

² Department of Chemical and Biochemical Engineering, North Carolina State University

Nanostructure Assembly from Hybrid Peptide-Polymer Macromolecules

Jose Dominguez,¹ Sarah Warren,¹ and Tania Betancourt^{1,2}

¹ Department of Chemistry and Biochemistry, Texas State University

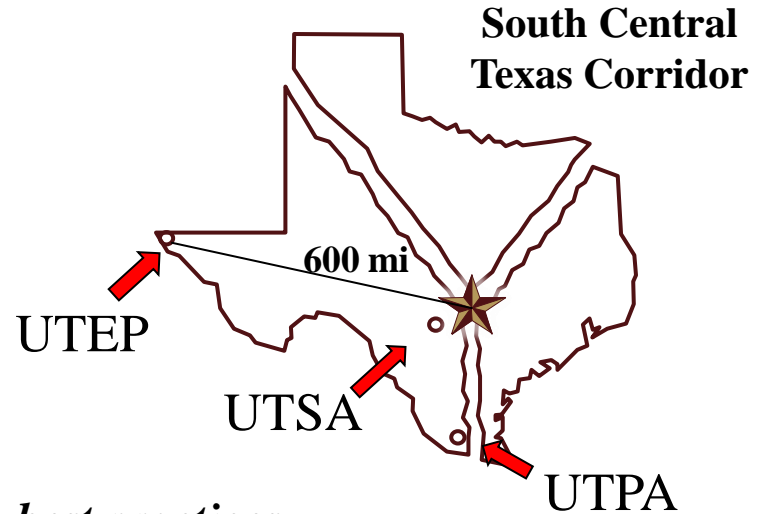
²Materials Science, Engineering, and Commercialization Program, Texas State University

Texas PREM Network



MRSEC Partners
Research Triangle
Minnesota
Santa Barbara
Northwestern

Texas State
PREM
Triangle
MRSEC



Share best practices
Joint student conferences
Share facilities MRFN

Texas PREM Network Booth at
SACNAS, San Antonio – Oct, 2013

Texas State University SACNAS student chapter
\$5k from Equity&Access – student organized seminar program



PREM Academy – Class of 2012

Mornings- Laboratory work
PREM Faculty

- surface chemistry
- colloids
- polymer nanoparticles
- photochromism
- superconductors

Afternoons – Project Development
Gulacar, consultants (UT Austin)

- Legacy Cycle – project units for TEKS (Texas Essential Knowledge and Skills)
- POGIL – process oriented guided inquiry learning
- Vernier Technology – LabQuest, probes and sensors

Kits will be provided to participants and modules disseminated on website.



July 30 – August 3

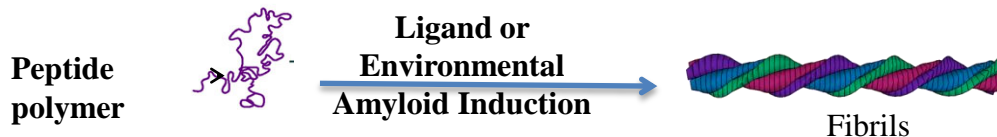
- Stephanie Hart –Manor New Tech High
- Stuart Ray- Manor New Tech High School
- Abigail Randall-Akins High School-Austin
- Christina Jenschke-Akins High School-Austin

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TEXAS
STATE
UNIVERSITY
SAN MARCOS

The rising STAR of Texas

Basis of Collaboration is Personnel Exchange



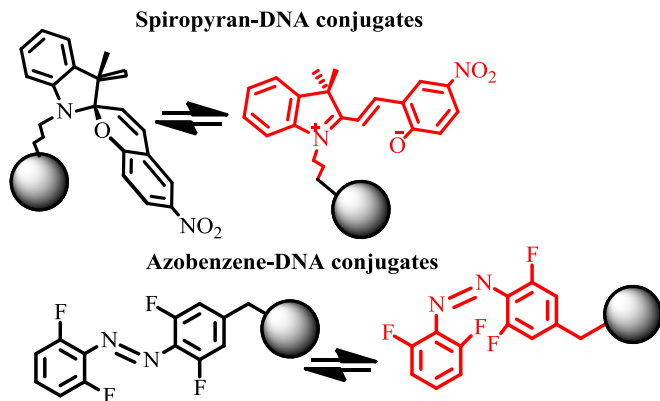
Hall visit to TxState
 ↓
 Co-writing proposal with Betancourt

Whitten visit to Triangle
 ↓
 Joint presentation with Yingling

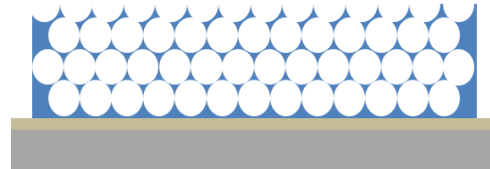


Brittain visit to Triangle
 ↓
 Sample exchange – REU student Zauscher

Irvin visit to Triangle
 ↓
 Active projects in Velev & Wiley groups – REU Student
 ↑
Velev visit to TxState



Colloidal templating of conducting polymers

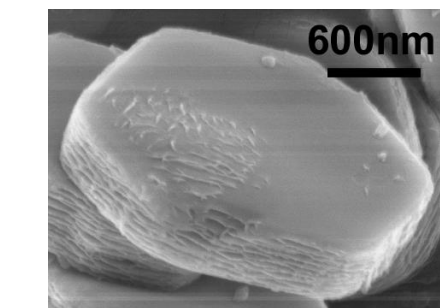
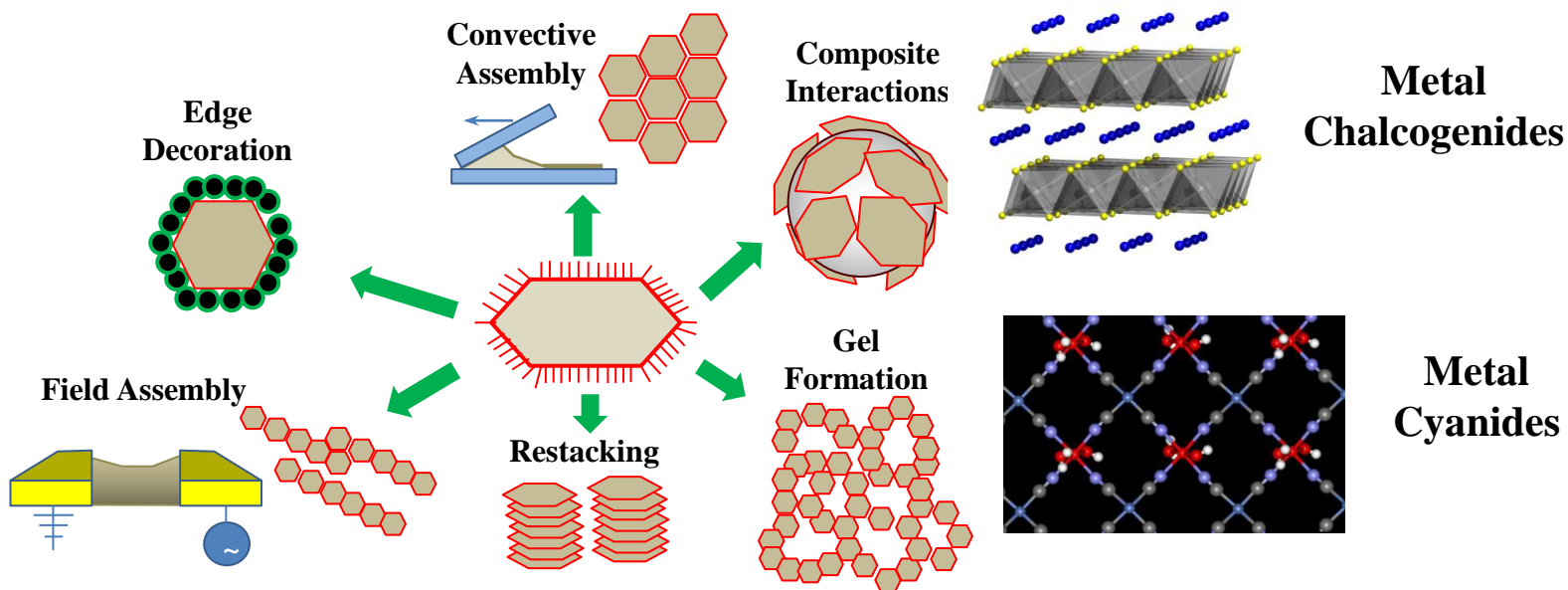


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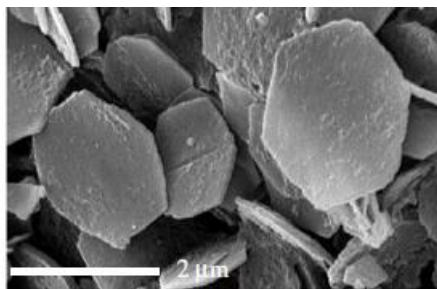
Directed Self-Assembly of 2-Dimensional Nanosheets

TxState: G. Beall, B. Martin, L. Sun

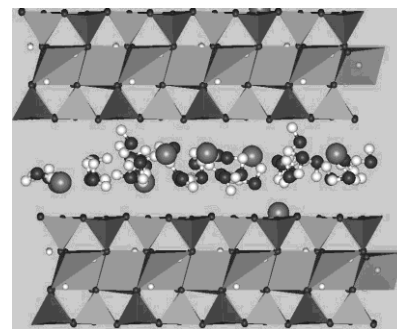
MRSEC: C. Hall, G. Lopez, J. Tracy, O. Velev, B. Wiley



α -Zirconium
Phosphate



Layered Double
Hydroxides

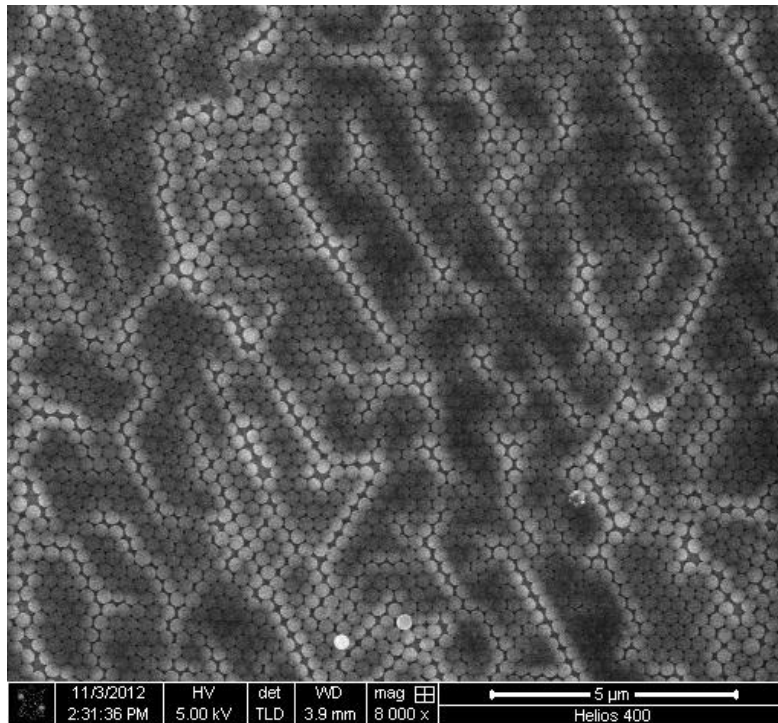
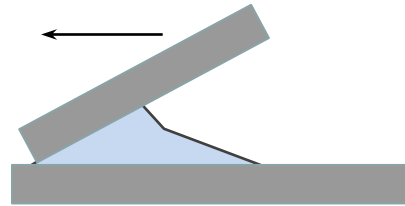


Smectic
Clays

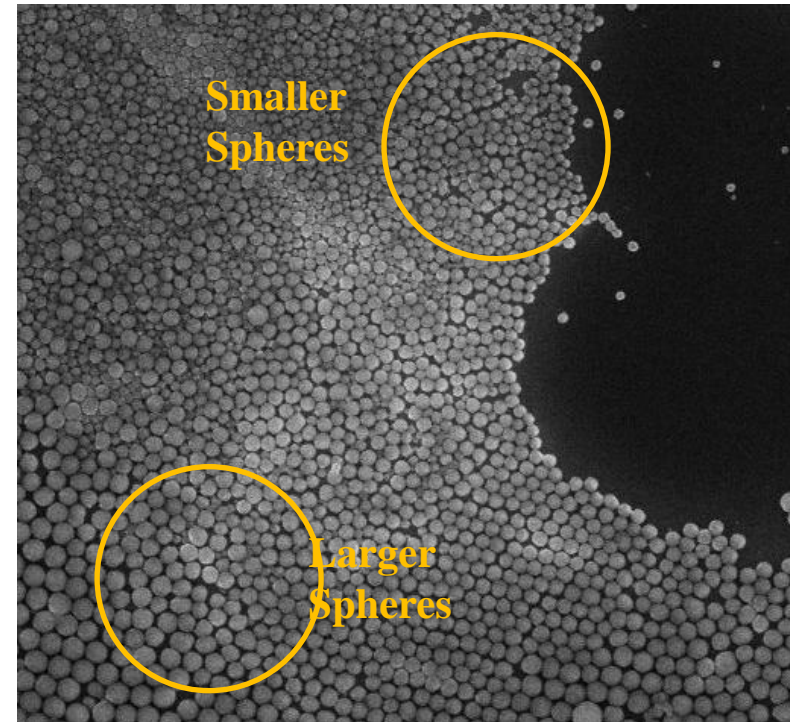
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Convective Assembly



Nearly monodisperse spheres generate line defects

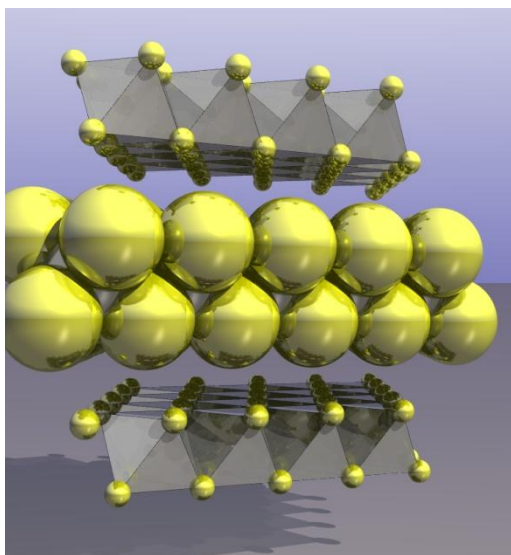


Polydisperse spheres phase segregate

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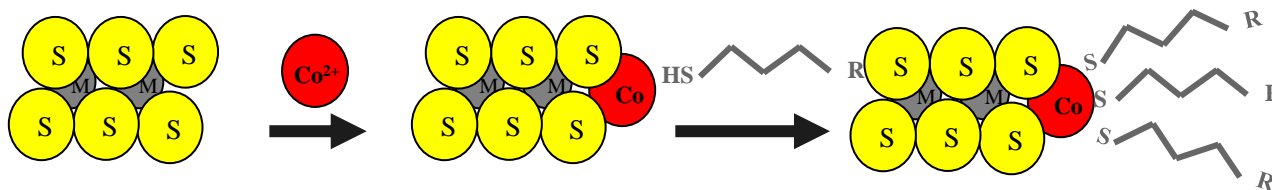
Edge Modification of MoS₂



MoS₂

- Most studied layered chalcogenide
- Composed of edge-shared MoS₆ octahedra
- Empty interlayer galleries

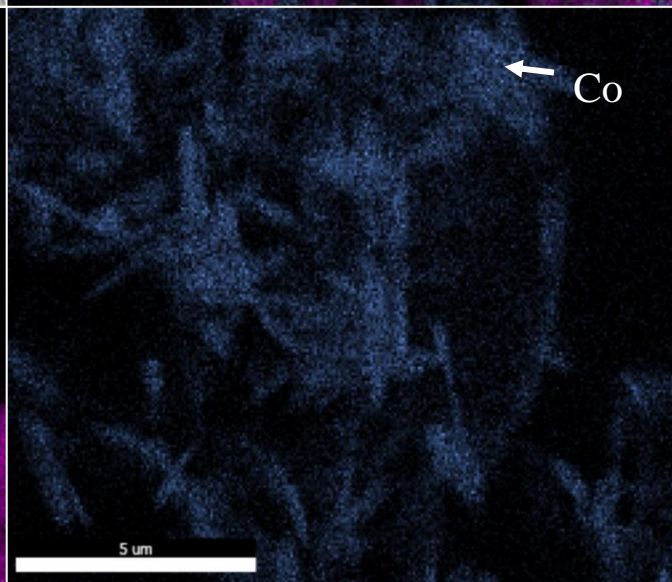
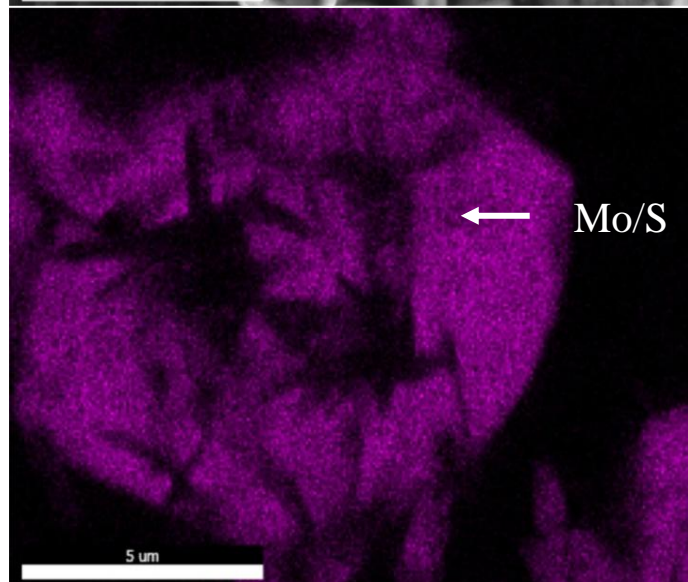
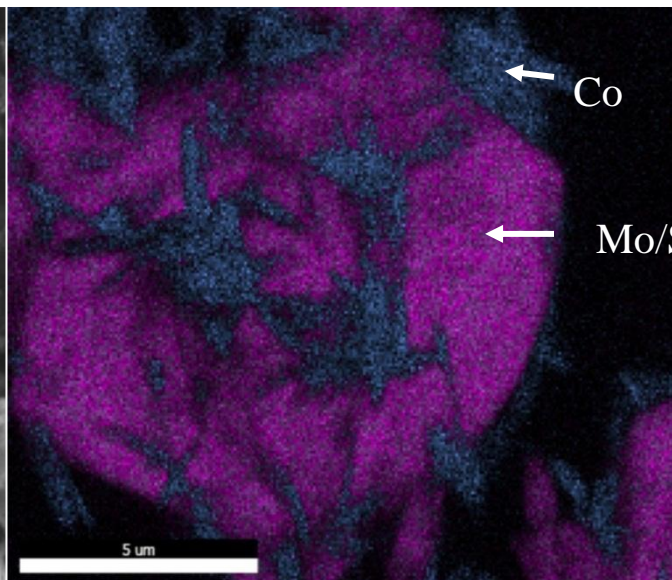
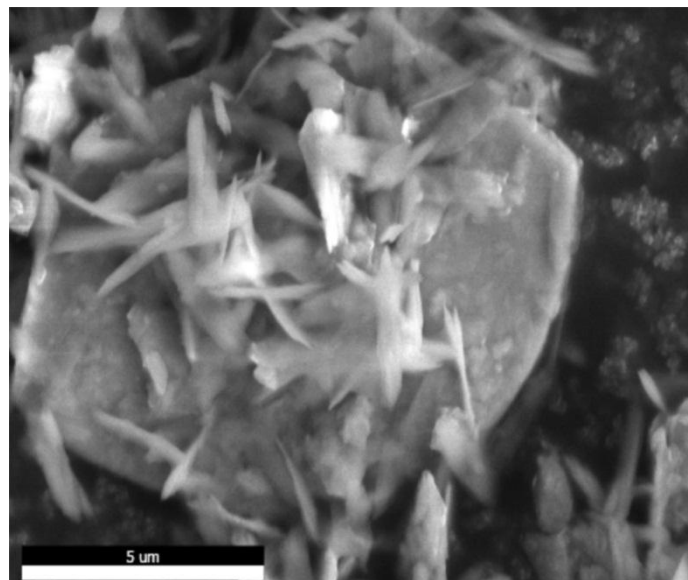
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EDAX Mapping Analysis of Modified MoS₂

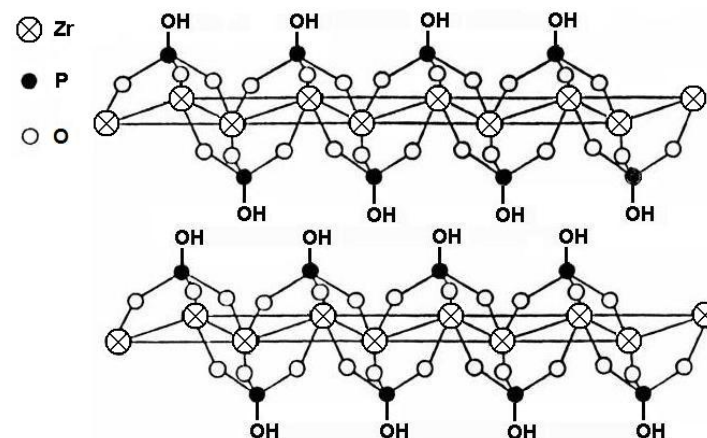
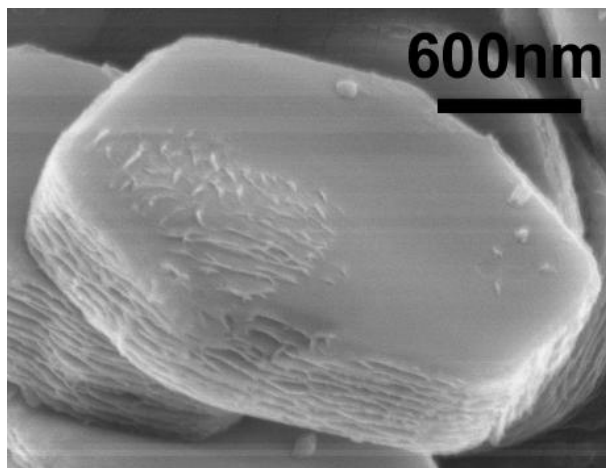


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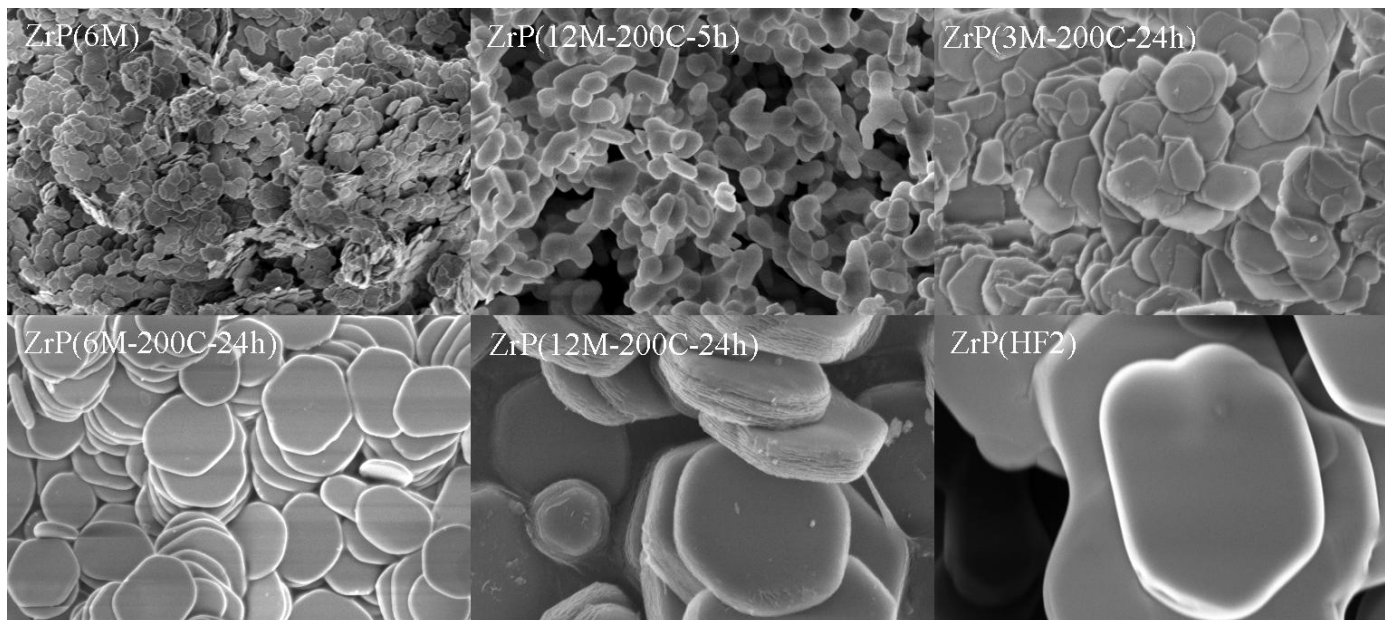




α -Zirconium Phosphate (ZrP)



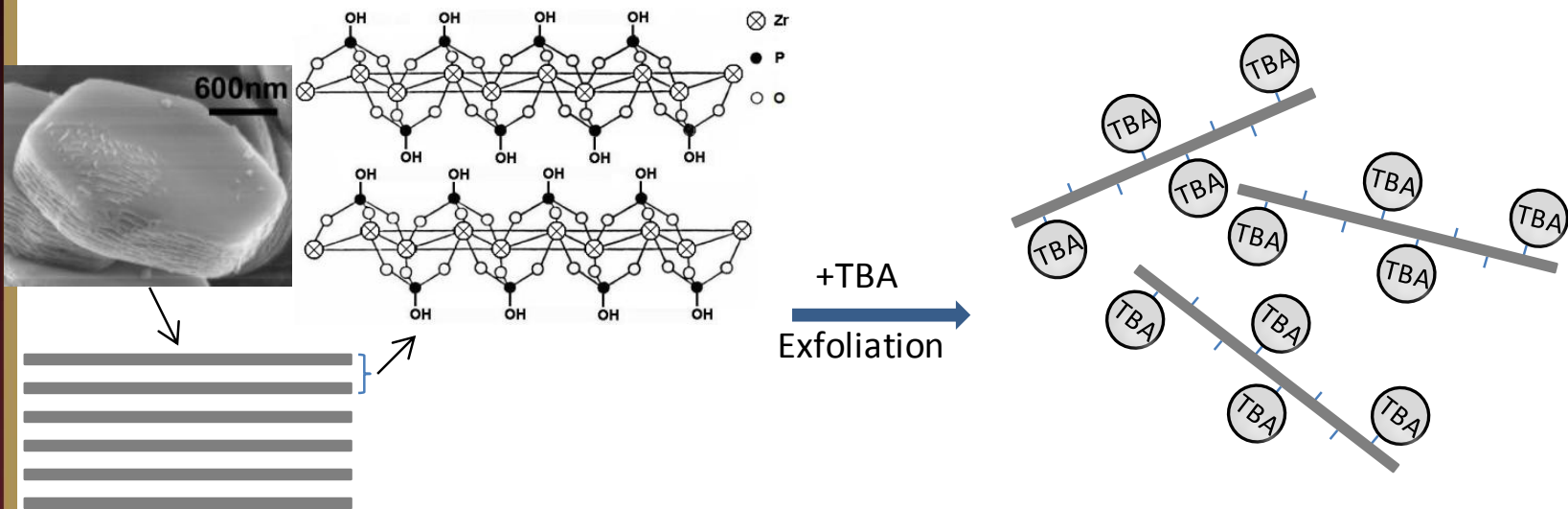
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1 μ m



Exfoliation of ZrP Microcrystals to Individual Nanosheets



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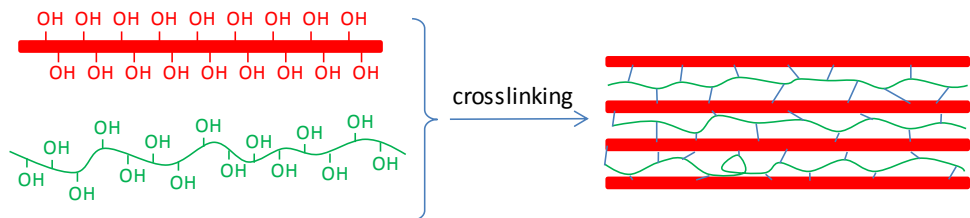
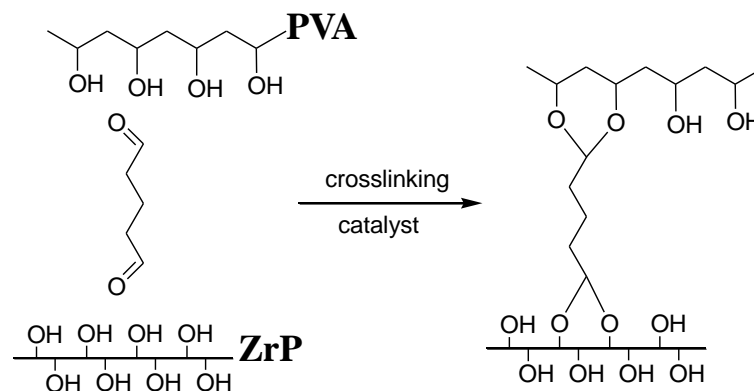
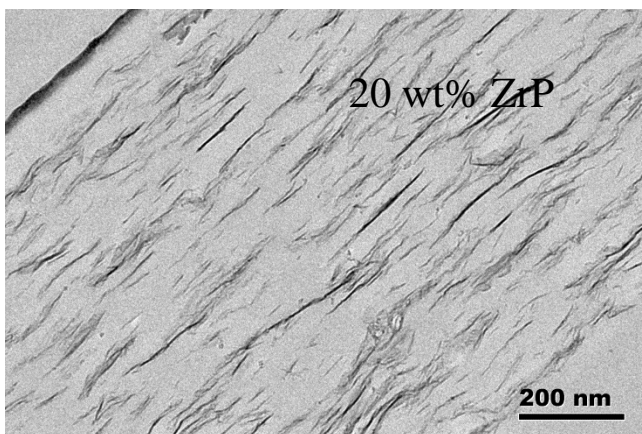
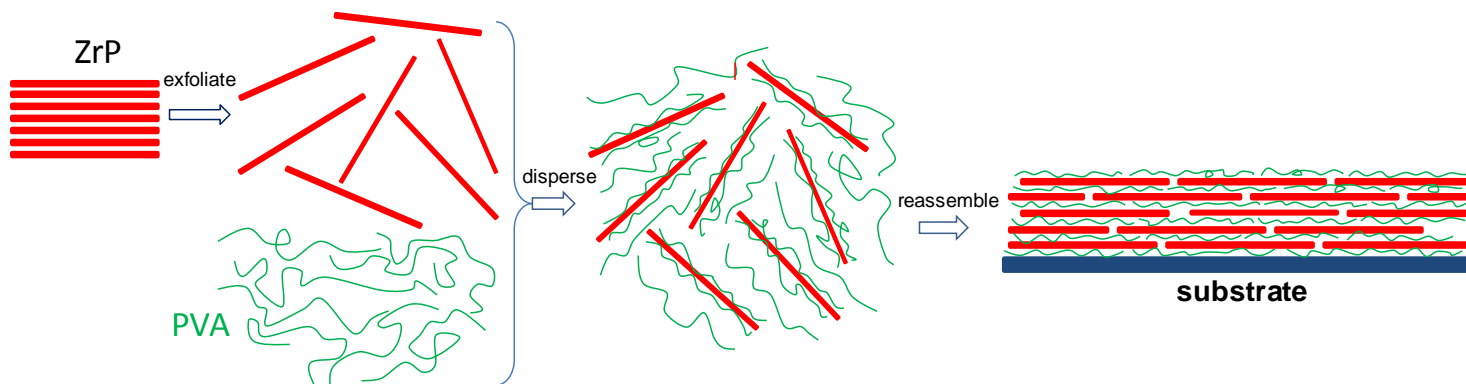
Before exfoliation



After exfoliation

Kim, H.N.; et al. *Chem. Mater.* 1997, 9, 1414; Sun, L.; et al. *Chem. Mater.* 2007, 18, 1749.

Co-assembly of ZrP Nanosheets with Polyvinyl Alcohol (PVA) to Form Thin Coatings

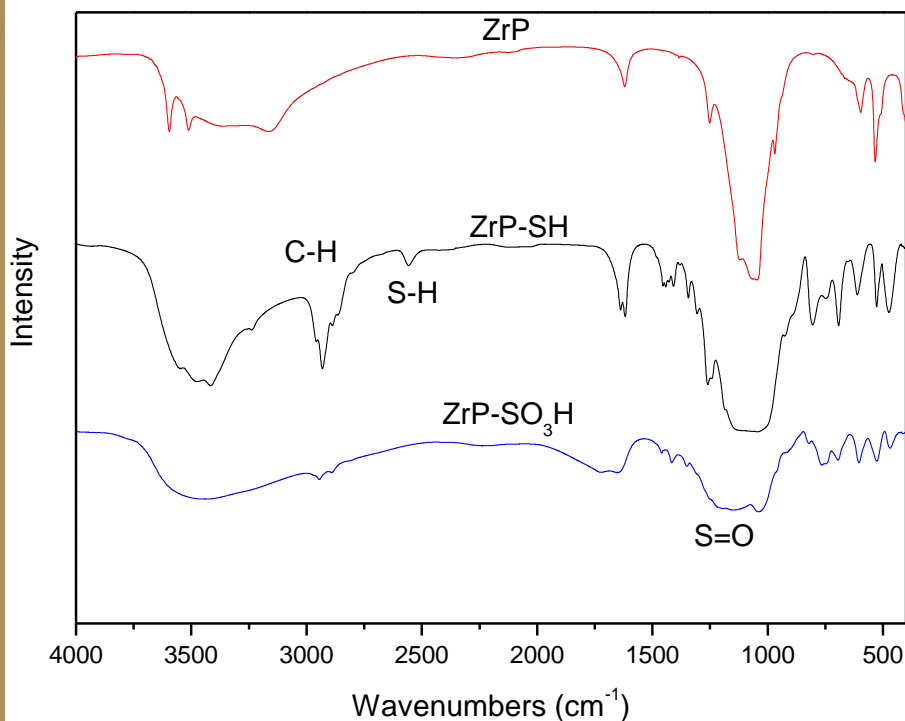
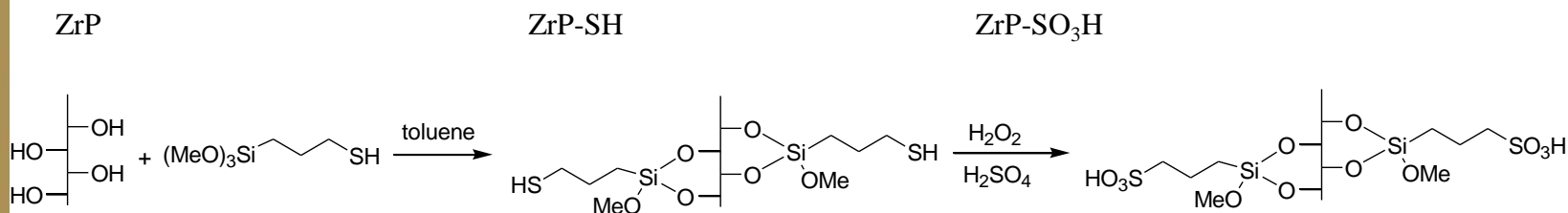


- ZrP nanosheets well aligned along substrate and crosslinked with PVA
- Maintain high transparency
- Excellent barrier and mechanical properties and flame retardancy



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Functionalization of ZrP Nanosheets



- Surface functionalization of ZrP individual nanosheets to ZrP-SO₃H has been achieved
- Self-assembly of ZrP-SO₃H nanosheets or co-assembly of ZrP-SO₃H nanosheets with polymers to form various nanostructures are underway
- ZrP-SO₃H, an immobilized super acid, may serve as a heterogeneous catalyst for a wide range of reactions. Evaluation of ZrP-SO₃H as a heterogeneous catalyst is ongoing



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