

Innovative Polymeric Nano Materials for Unconventional Thermal Transport Control

Tengfei Luo

Assistant Professor

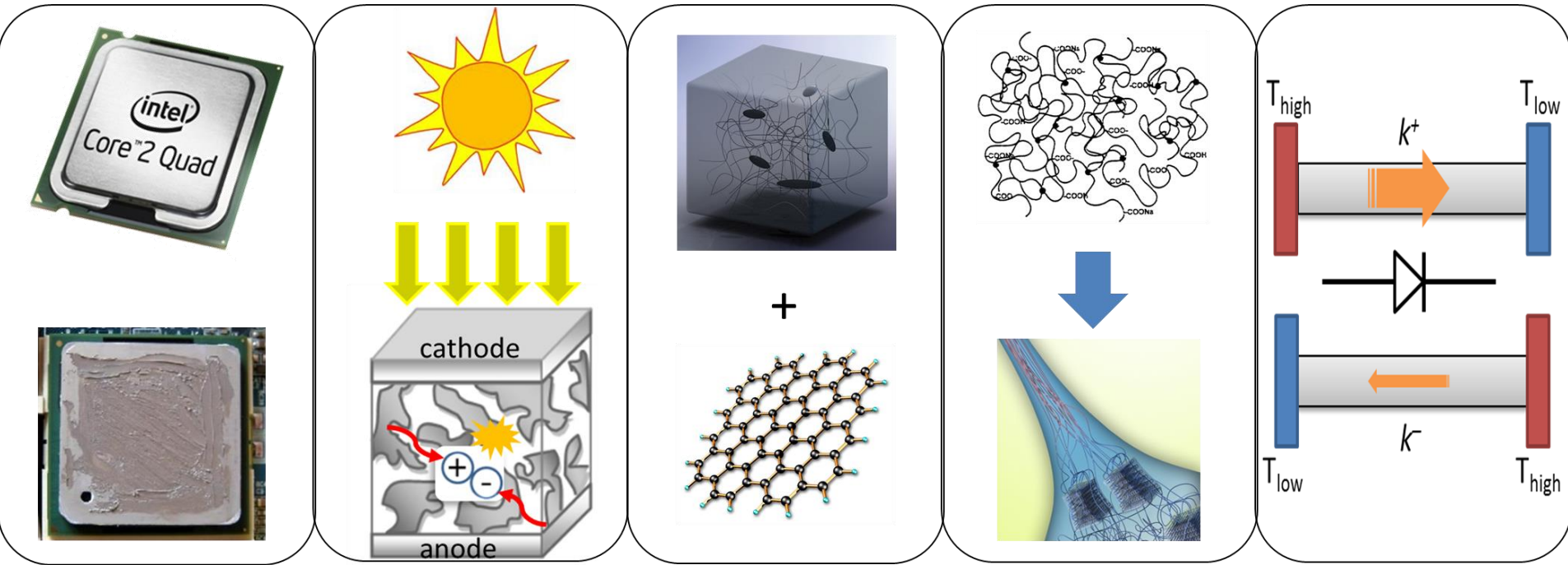
Aerospace and Mechanical Engineering

University of Notre Dame

11th US-Korea Forum on Nanotechnology

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Thermal Transport in Polymers



Electronics

Polymeric Energy Devices

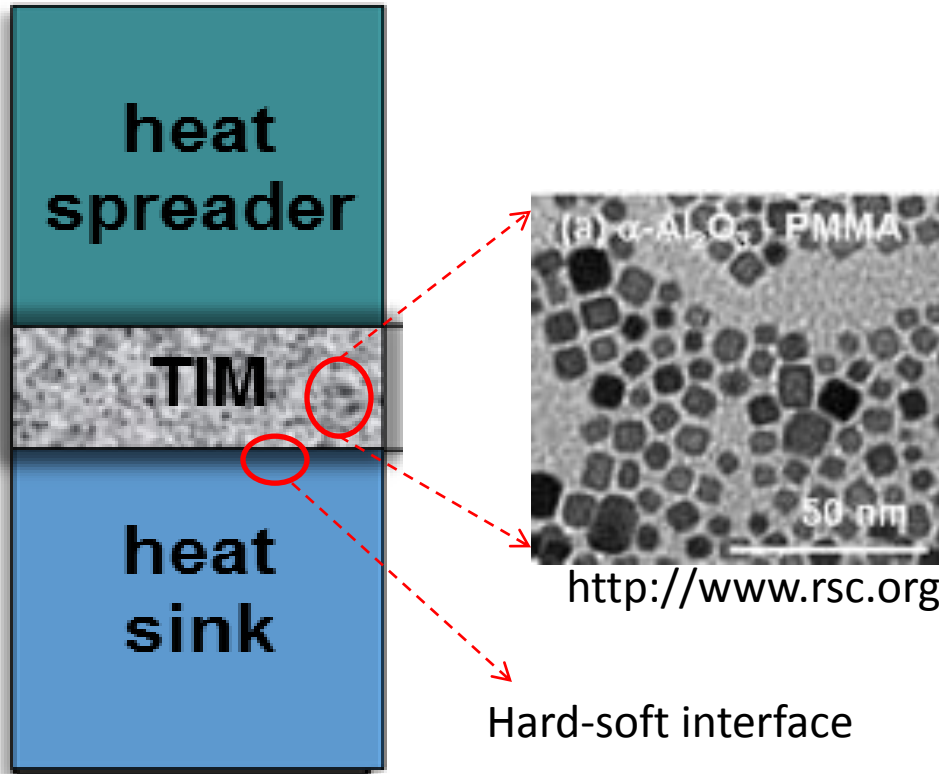
Composites

Fibers

Phononics

Thermal Transport at Hard-Soft Interfaces

Polymer nanocomposite



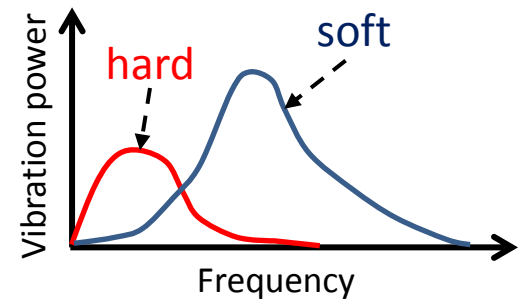
Hard-soft interface

Interfacial bonds:

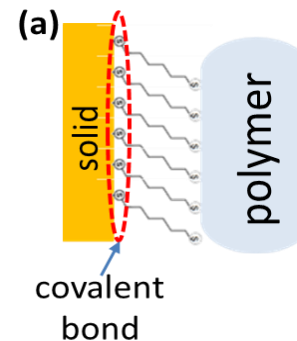
vdW $\rightarrow G \sim O(1-10)$ MW/m²K

Covalent $\rightarrow G \sim O(100)$ MW/m²K*

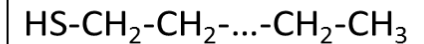
Vibration coupling:



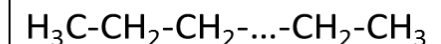
Molecular thermal bridge:



(b) Alkanethiol:



Polyethylene:



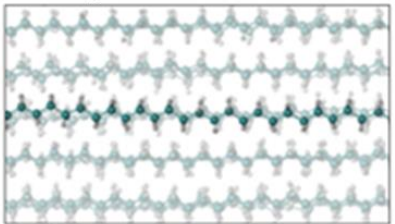
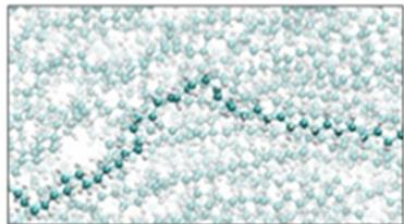
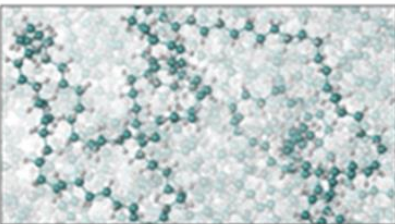
Manipulate Thermal Transport in Polymer Fibers

Polyethylene:

amorphous bulk

Ultra-draw

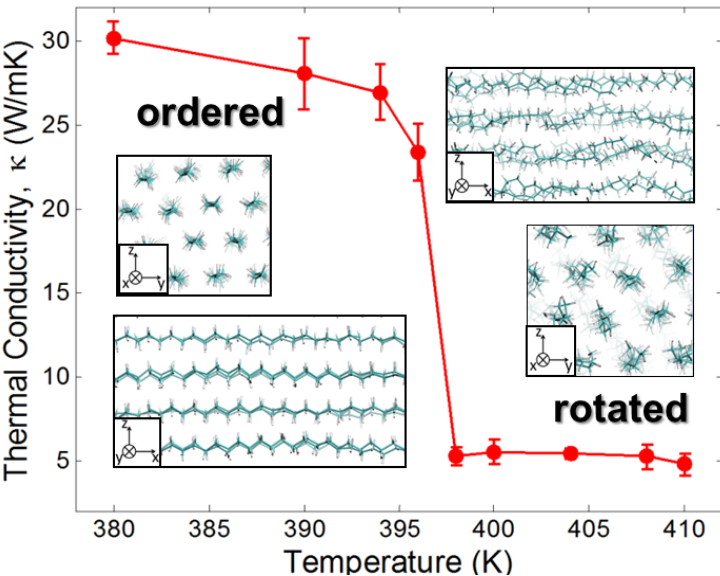
crystalline fiber



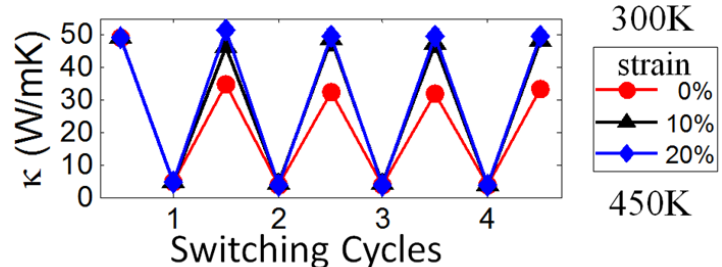
~0.3 W/mK

~100 W/mK*

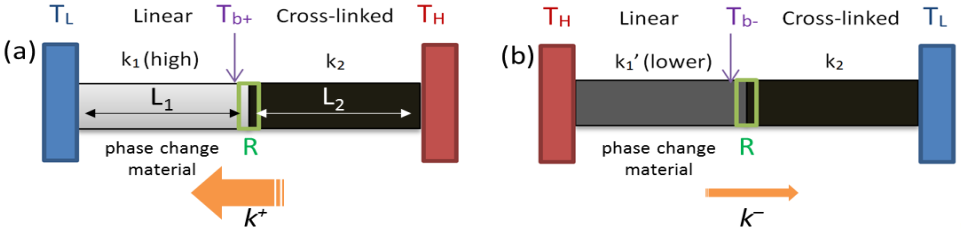
- Do other fibers have high(er) thermal conductivity?



Thermal switch:



Thermal diode:



Thank you!

Questions?

Come to see poster:

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