

# Nanostructure Discussion Group Summary

First need to properly define Nanostructure (vs. nanomaterials)

e.g. carbon nanotube vs. nanocrystalline material

Observations span:

(1) fabrication

(2) characterization

(3) implementation

Need greater connection between modeling and experiments

e.g. need controlled strain/strain rate experiments

Need to promote connection between mechanicians and physical scientists

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Need to better understand boundary conditions

thermal

mechanical (e.g. joining, clamping → building blocks)

electrical

Need to better understand and control environmental effects

e.g. mechanical: noise floor, EM, acoustic

e.g. chemical: relative humidity, surface chemistry

Need improved nanomanipulation

e.g. control of interaction force

e.g. force transduction (across boundaries, dissimilar materials)

Recognize that nanostructures are particularly sensitive to imperfections

e.g. surface defects, vacancies, impurities

e.g. need greater focus on surface oxides

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Recognize that traditional mechanics models may not apply to nanostructures

Must understand appropriate structural level building blocks

e.g. appropriate structural members (sub-units for molecules)

joining and integration of dissimilar materials such as soft-hard material integration

May try to use nanostructures to *measure* properties of materials

Must take advantage of coupled behavior (mechanical-electro-opto)

Need to integrate nanostructures up to a human length scale

Want to surpass what biology can do

e.g. force transduction

e.g. high strength (how to we use this?)

e.g. controllably manipulate atoms in nanostructures

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Recognize that it may not make sense to reproduce 18<sup>th</sup>-19<sup>th</sup> century structures at the nanoscale – maybe should be taking advantage of new *functionality*.

Control of mechanics at nanoscale can feed into advances in other fields e.g., bonding and orientation in CNTs can couple to fs optical spectroscopy studies