

# FRG: Synthesis of Well-Defined Nanosize Particles and Their Role in the Formation of Simple and Composite Monodispersed Colloids

Grant DMR-0102644

PI: E. Matijević, co-PIs: M. Borkovec, D. Goia, V. Privman

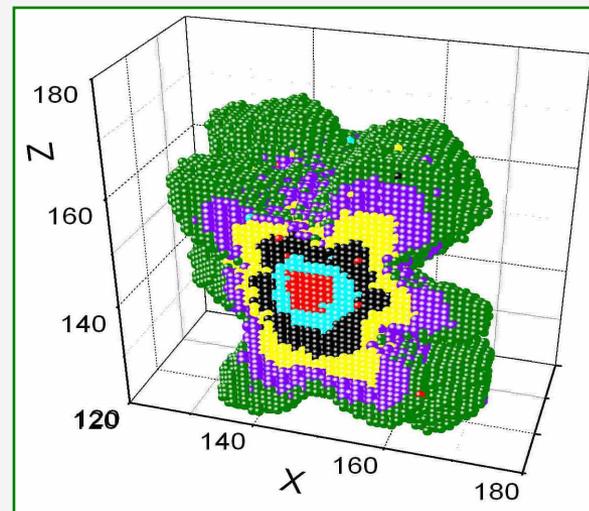
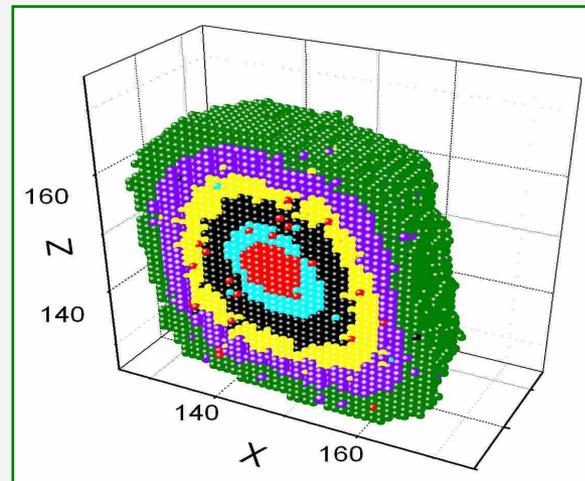
## Objectives

- Identify the key parameters to predictably produce monodispersed particles of desired size, shape, and internal structure for various applications
- Elucidate experimentally and theoretically the formation mechanism of monodispersed colloidal particles by aggregation of nanosize precursors

## Achievements

- The aggregation process of nanosize precursors was studied experimentally for several representative systems (CdS, Au, Pd, CuO), and the parameters that control the size distribution and internal structure were identified
- A theoretical model, which accounts for cluster-cluster aggregation and predict the particle size selection was developed and implemented numerically. The calculations matched experimental results at different times.

Numerical modeling visualizing the regimes of stability of the particle shapes in synthesis by aggregation of nanosize subunits.



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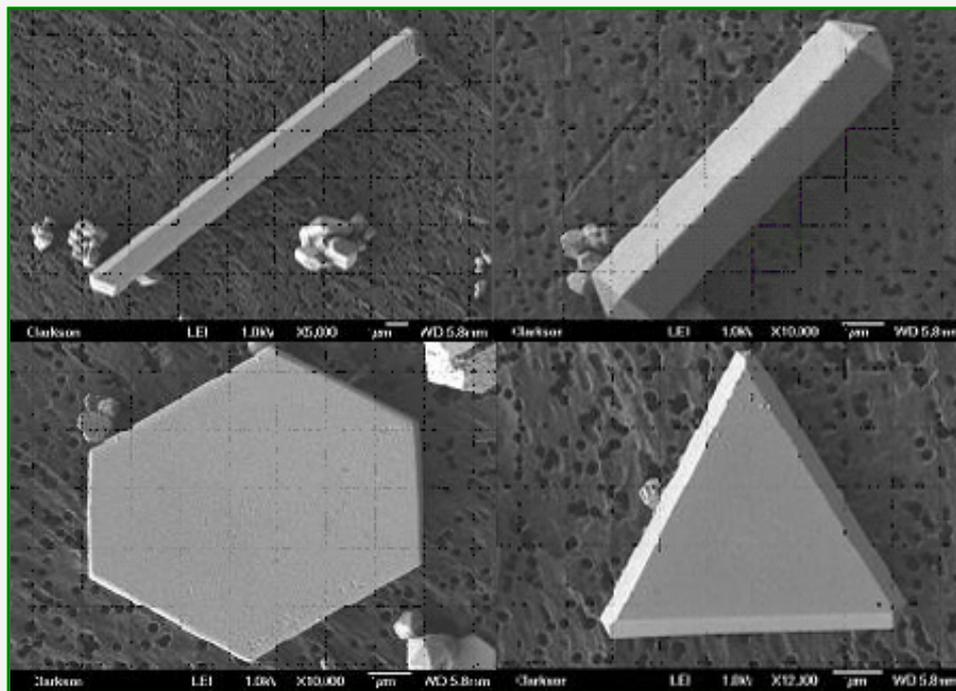
## Education and Outreach

- graduate, undergraduate students, and postdocs
- courses in academia
- courses in industry
- national security applications (US Army)

## Industrial Applications

The understanding of the aggregation mechanism has made possible the development of commercial products in joint efforts with, and funded by, various partners:

- catalysts for fuel cells (Umicore)
- electronic materials (Nanodynamics Inc.)
- drug delivery (Cytimmune Inc.)
- obscurant smokes (U.S. Army)
- fluorescent particles for medical diagnostics (Coulter)
- nanosize drugs (élan technologies)
- photolithography (Lincoln MIT Lab)
- slurries for chemical mechanical polishing (IBM, Intel)



Experimental demonstration of the control of particle shape of micrometer-size polycrystalline Cu particles for National Security applications.