NANO HIGHLIGHT
NIRT: Total Chemical Synthesis, Modeling and Property Study of Nanoparticle/Polymer Hybrid Materials

NSF NIRT Grant 0506531

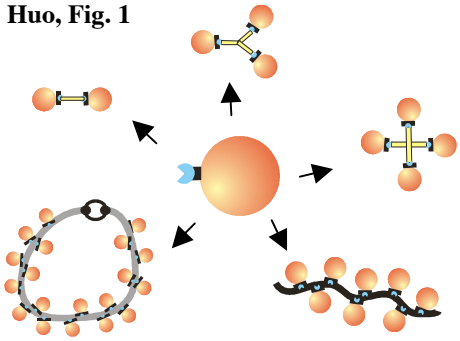
PIs: **J. Brennan,[1] W. Sun,[1] W.H. Zhong[1] and Q. Huo[2]**
[1]North Dakota State University, [2]University of Central Florida

The objective of our research is to develop nanohybrid materials with new optical, electrical and thermal properties that may have a wide range of applications. Our team consists of material chemists, optical physicists and engineers, and mathematicians. This research project offers unique opportunity for the training of next generation scientists who will be able to carry on multidisciplinary research as required by nanoscience and nanotechnology development.

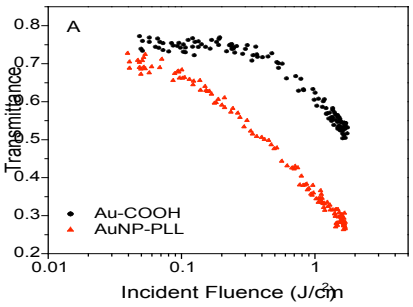
The main thrust of our research is to use a unique total chemical synthesis approach to develop nanoparticle/polymer hybrid materials with well controlled architectures and properties. We recently reported the synthesis of a monofunctional gold nanoparticle material which behaves like a "molecule". Using these molecular nanobuilding blocks, we succeeded to use extremely simple chemical reactions to make exotic nanoarchitectures such as nanopairs, nanonecklaces, nanochains, and nanoparticle clusters with well-controlled properties (**Huo, Fig. 1**). From these materials, we discovered some unique nonlinear optical properties, which are very important for laser protection (**Sun, Fig. 2**). We also prepared a nanoparticle/polymer hybrid material that shows decreased electrical resistance compared to pure polymer (**Zhong, Fig. 3**). Furthermore, we recently started to explore and develop a mathematical model for nanoparticle growth (**Brennan, Fig. 4**). This study may lead to better solutions for the synthesis of nanoparticles with better controlled size and properties. In summary, through these comprehensive studies, one can expect to obtain a much better understanding on nanomaterials and how to develop materials with well controlled properties for various applications.

References: a) Worden, J.G. et al, Chem. Comm. 2004, 518. b) Dai, Q. et al. JACS 2005, 127, 8008. c) Worden, J.G. et al, Chem. Mater. 2004, 16, 3746. d) Shaffer, A.W. et al Langmuir 2004, 20, 8343. e) Sun, W. et al. JPCB 2005, ASAP

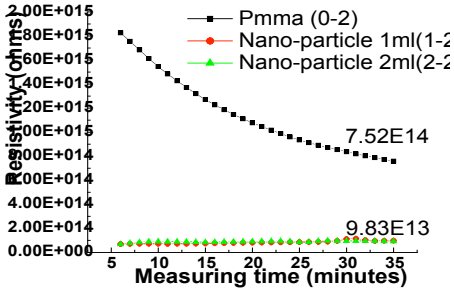
Huo, Fig. 1



Sun, Fig. 2



Zhong, Fig. 3



Brennan, Fig. 4