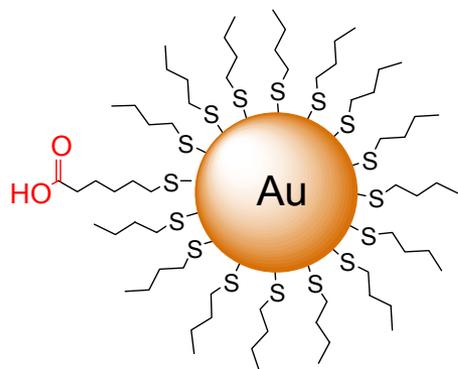
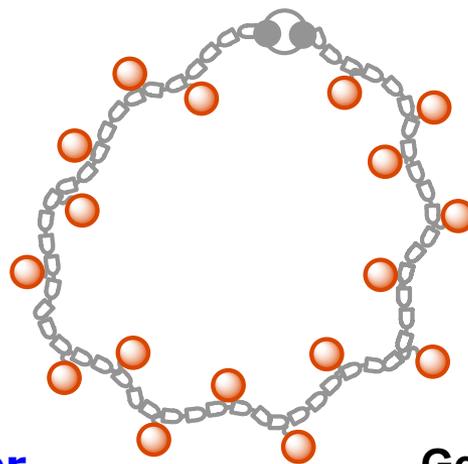


CAREER: Gold Nanoparticles with Single Surface Functional Groups: Synthesis and Study

PI: Qun Huo, North Dakota State University, DMR-0239424



"Nanonecklace"



Molecular nanoparticle

+

Polymer

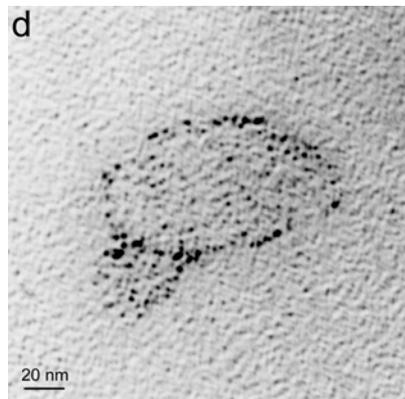
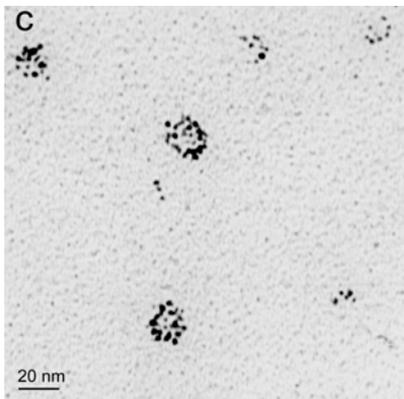
Highlight of the Results:

- First solid phase synthesis of monofunctional gold nanoparticles, a type of nanoparticles that can be treated and used like traditional molecules
- Using a polylysine polymer as a skeleton, the molecular nanoparticles are reacted together into a nanonecklace through a one step reaction
- This ring-closed nanonecklace could find important applications in separation, catalysis, devices and nanomagnets
- Results obtained so far demonstrate that nanomaterials can be developed through "**total chemical synthesis**", which means the material structure and property can be controlled and reproduced truly at molecular level!

General Impact:

- Development of a synthetic strategy towards controlled chemical functionalization of nanobuilding blocks
- Demonstration of an unprecedented approach in nanomaterial design and synthesis

News: Our Chem. Comm. article was listed among the top ten most accessed articles in February 2004



1. Worden, J.G.; Shaffer, A.W.; Huo, Q. Chem. Comm. 2004, 518
2. Shaffer, A.W.; Worden, J.G.; Huo, Q. Langmuir 2004, 20, 8343
3. Worden, J.G.; Dai, Q.; Shaffer, A.W.; Huo, Q. Chem. Mater. 2004, 16, 3746
4. Dai, Q.; Worden, J.G.; Huo, Q. Submitted to J. Am. Chem. Soc.
5. Patent Application: Huo, Q.; Worden, J.G. US patent filed on March 5th, 2004.

CAREER: Gold Nanoparticles with Single Surface Functional Groups:

Synthesis and Study: *PI: Qun Huo, North Dakota State University, DMR-0239424*

Education:

Total five graduate and undergraduate students worked on this project (James Worden, Andrew Shaffer, Jonathan Trullinger (under), Qiu Dai, Xiong Liu). Andy received his M.Sc. Degree in June 2004. One more undergraduate student has been recruited to work on this project starting from Fall 2004
Publications: Three papers published and two manuscripts submitted on this work by Jim, Andy, Jon, and Qiu.

Student training: Jim and Qiu attended the two-week American Chemical Society Summer School on nanoparticle materials at Ypsilanti, Eastern Michigan University in the summer 2004 and met many interesting friends and colleagues there. Jim and Qiu will also attend the International Congress on Nanotechnology this Fall in Oakland San Francisco

Student news: Jim received an NSF EPSCoR Doctoral Dissertation Assistantship (\$33,000) for his research on gold nanoparticles

Outreach:

Dr. Huo is working with a graduate student Haiou Xiang and Prof. Ken Nygard from our computer science department to develop an online short course on “Nanomaterial 101” to freshman undergraduate students and general public community

Dr. Huo initiated and helped to develop a close and formal working relationship between our department and the Department of Polymer Science and Engineering at the University of Science and Technology of China.

Nanoparticle wires dancing on a cliff at North Dakota badlands!

