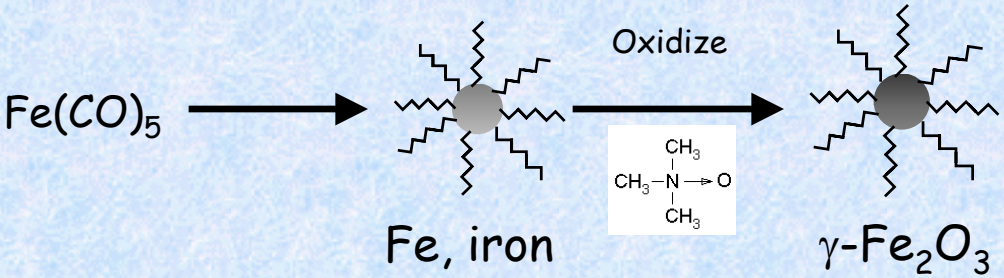
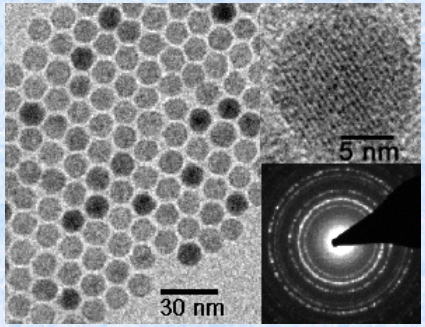
Columbia MRSEC IRG Research Highlights - 2002

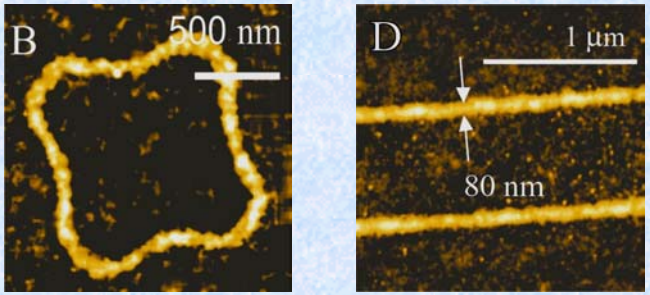
Synthesis of Nanoparticles



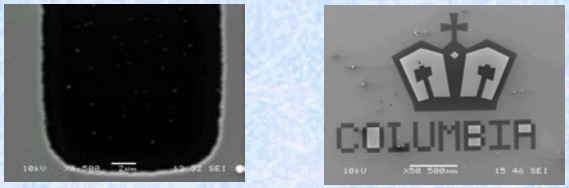


Maghemite
(O'Brien, Redl, Murray)

Assembly of Nanoparticles into Films



CdSe nanocrystals assembled on Edge Transfer Lithography-patterned SAMs (Adams)



Electric-field assisted assembly
(Herman)

Explanation

Synthesis of nanoparticles: The approach is controlled oxidation of synthesized Fe nanoparticles, to form maghemite. This is a collaboration with Chris Murray at IBM Watson Research Center, through the MRSEC bridging postdoc Franz Redl.

Assembly of Nanoparticles into Films: Edge Transfer Lithography is a derivative form of stamping methods, using transfer at the edges. (SAMs are self-assembled monolayers.) Electric-field assisted assembly uses static, uniform electric fields for patterned or unpatterned formation of (in this case CdSe/TOPO) nanoparticle films.

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Broader Impacts

Broad impact in new types of nano-based materials
- new ways to synthesize nanoparticles and to assemble them
- potential impact in microelectronics, optoelectronics, catalysis, etc.
- also linked to new methods of characterization and theory of broad interest

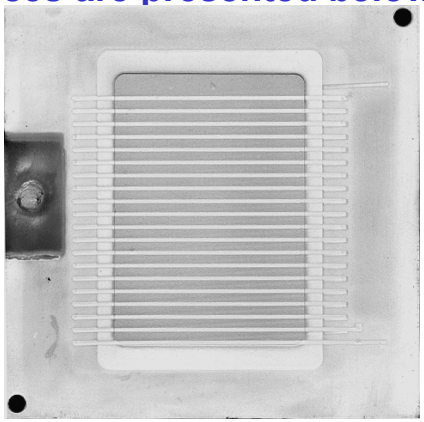
Participation in this research by many graduate students, postdoctoral scientists, and undergraduate students (academic year and summer), and high school teachers

Interaction with IBM with a bridging postdoctoral scientist

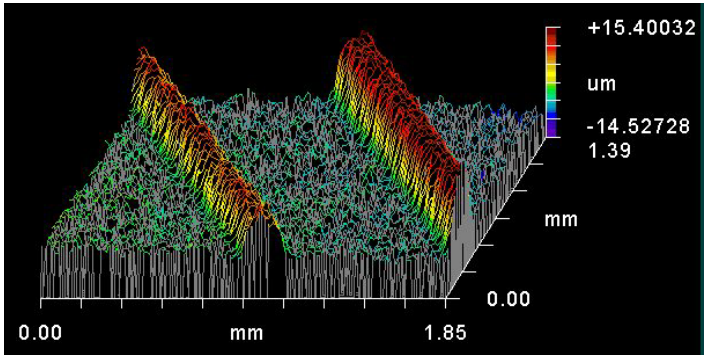
Transforming Thermal Spray Technology through Science:

From Protective Coatings to Direct Write Multilayer Electronics and Sensors

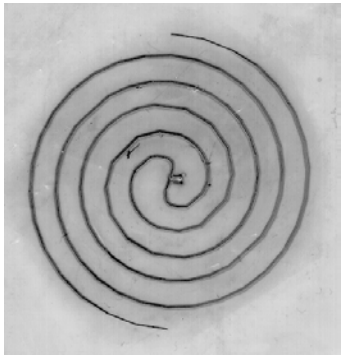
The Center for Thermal Spray Research is poised to tranform electronics and sensor technology by introducing a radically new approach to fabricating thick film materials through a maskless low temperature direct write process. Funded through DARPA's Mesoscopic Integrated Conformal Electronics (MICE) program and benefitting from MRSEC enhanced science base and facilities, the Center is creating novel opportunities in materials synthesis and applications. Some examples of devices are presented below.



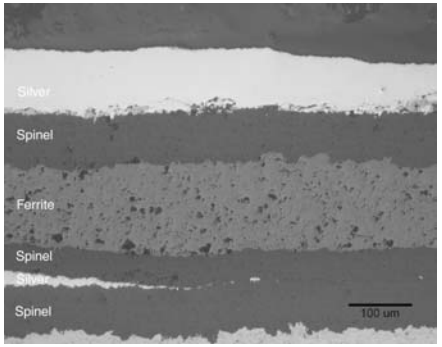
High-frequency inductor



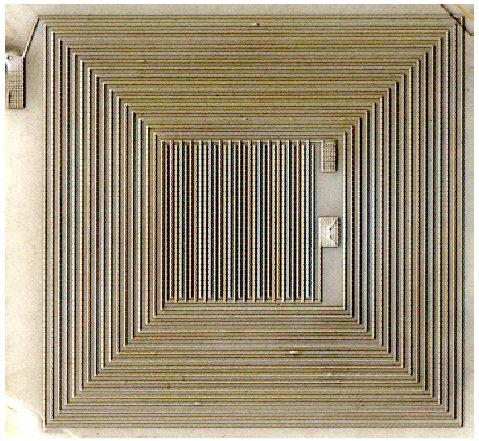
Direct write lines



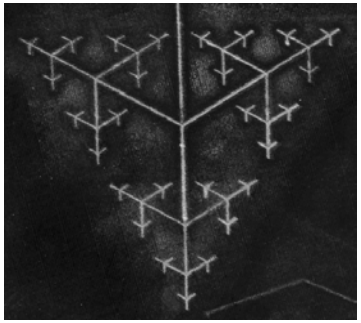
Double spiral antenna (silver on alumina)



Inductor Cross-section



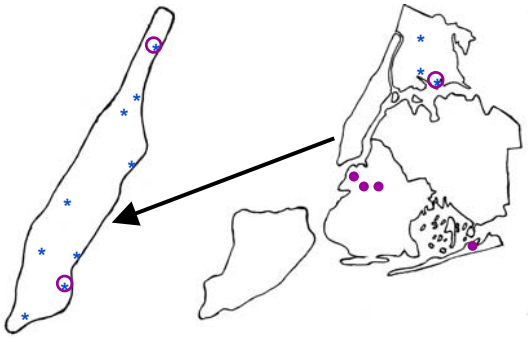
LC Resonance Circuit



Direct write antenna on cloth

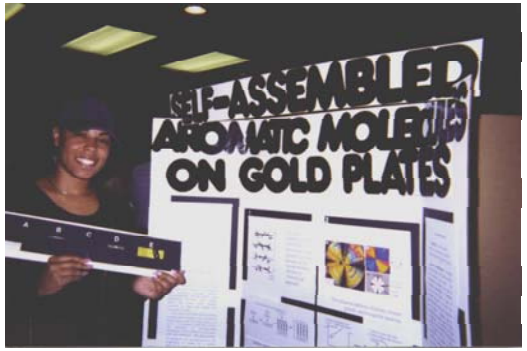
Columbia MRSEC Education/Outreach Highlights

Our First Visit to a Junior High School – JHS 126 in Brooklyn



Including the Spring of 2002, we have now visited 16 different NYC schools.

Visits to NYC High Schools and Middle Schools



Research Experiences for Teachers (RET) – Khadija Vann of Far Rockaway HS returns for a 2nd summer in 2002

Research Experiences for Undergraduates (REU) - Students in the Summer 2002 Program