



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

Name(s) Rui Wu	Project Number S0525
Project Title Iron Nanowire Fabrication through Electrochemical Step Edge Decoration on Highly Oriented Pyrolytic Graphite	
Objectives/Goals I wish to construct Fe wires through an electrochemical process that has the capability to generate high density nanowires with small diameters. Through step edge decoration on graphite, I want to develop a growth process for the iron wires.	
Abstract Methods/Materials Materials: Counter electrode (made from stainless steel wire with mercury and platinum flag encased in a glass rod), reference electrode (Fe wire and a Saturated Calomel Electrode), working electrode (made from stainless steel encased in a Teflon tube), FeSO ₄ , Na ₂ SO ₄ , nitrogen, desiccant, potentiostat with computer software PowerSuite, Scanning Electron Microscope, energy dispersive x-ray spectroscope. Procedure: Initially, cyclic voltametry must be done using the potentiostat on the 12 mM FeSO ₄ , 0.5 M Na ₂ SO ₄ solution to select the proper growth and nucleation potentials. Then, the instruments for the electrodeposition process must be made with carefully selected materials. Trials are done against an SCE and Fe wire reference electrode and various oxidation, nucleation, and growth potentials were used. Samples were taken to the SEM and also EDXed to make sure they were indeed Fe. Visual evidence of iron wire creation can be taken from the electron microscope.	
Results Wire creation occurred best at conditions of oxidation at 1.1 V for 4 sec., nucleation at #2 V for 60 ms, and growth at #1 V for 600 sec against an Fe wire used as the reference electrode. Wires with diameters of approximately 60 nm have been created. Nitrogen bubbling during growth and desiccation to prevent Fe oxidation after deposition seemed to improve results. SEM and EDX confirmation of Fe wires were done.	
Conclusions/Discussion Through the ESED process on HOPG, Fe wires can be made easily and efficiently. By altering the growth and nucleation time, the diameter and density of the wires can change. Such wires have potential in uses of chemical sensing and computer memory.	
Summary Statement Nanodiameter iron wires can be successfully constructed and easily controlled using electrochemical step edge decoration.	
Help Received Used equipment at UC Irvine in the lab of Professor Reginald Penner; Stacey Rogers and Ben Murray helped out with materials and direction of the project	