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GRADUATE RESEARCH ASSISTANT POSITIONS AVAILABLE

in

Materials Science and Engineering Department

University of Idaho, Moscow ID 83844-3024
Contact: Professor Batric Pesic, email: pesic@uidaho.edu; tel: 208-885-6569
http://www.webs1.uidaho.edu/nanomaterials

Available Positions

For those interested in receiving PhD degrees in Materials Science and Engineering, there are two openings in the Professor Batric Pesic's Laboratory for Electrochemistry. The positions will be filled as soon as possible. Spring 2006 Semester is an ideal starting time.

Project Funding

The project is supported by the major US chip manufacturer.

Project Description

The goals of the project are to study the electrochemical deposition of copper in vias and trenches coated with tantalum as copper diffusion barrier. With the development of ultralarge-scale integration (ULSI) circuits, low resistivity and good elctromigration resistance have become critical requirements for interconnect materials. Chip level metallization and particularly the extensive interconnect network that carries signals between the individual transistors have been fabricated exclusively of aluminum and aluminum copper alloys by vapor phase techniques. However this situation has undergone dramatic change after striking IBM's announcement in 1998/99 by which the company will replace the conventional vapor deposited aluminum by electroplated copper. Despite initial skepticism, the industry has adopted the copper plating process into chip fabrication. Never ending need for chip miniaturization requires thinner lines and smaller nodes, thus the conductivity is of essential importance. Copper is the second best known conductor, but its problem is diffusion into silicon matrix destroying a device (transistor, for example). For that reason, prior to copper electroplating, the silicon/silicon oxide substrates have to be precoated with very thin films acting as copper diffusion barriers. The industry is using/studying various copper diffusion barriers, TaN and TiN being the most popular.

There are many research challenges on this project, such as: copper electroplating in deep vias and trenches, copper electroplating on diffusion barriers (with and without prior copper seeding), adhesion of diffusion barriers, adhesion of copper lines onto the diffusion barriers, morphology of copper deposits, conductivity/resistance of copper lines, integrity (deposits without voids) of copper lines and vias, copper grains structural distribution, chemistry of the plating bath and electrodeposition, and so on.

Research Facilities

By working in Professor Pesic's laboratory the grad students will have their "own equipment" for the given research, such as Atomic force/scanning force microscope (DI-Nanoscope IIIa), Plasma etchers (Axic), Sputterer/evaporator (Denton-Discovery 14) Nanoimprint lithograph (Obducat), Scanning Electrochemical Microscope (CH Instruments), Spin coater, Electrochemical instrumentation for DC (Princeton Applied Research) and AC electrochemistry (Solartron). In addition, Professor Pesic may acquire his own benchtop SEM/TEM microscope (LVEM5). The major advantage of having own equipment is that the students do not have to sign up and have long waiting periods to do their research, as typically found in centralized user facilities.

Stipends

US $100,000.00 each for a four-year PhD program.

Stipends include salary, tuition and health insurance.

Who Should Apply

Ambitious and highly motivated grad students with strong background in either of the following disciplines: materials science and engineering, chemistry and chemical engineering, physics, mechanical engineering, and electrical engineering. When applying, please provide vitae, two letters of recommendation, and an essay describing personal reflections toward science, work ethics, organizational skills and ability to endure scientific challenges.