Introducing Nanoscience to Education and Student Research at Jackson State University

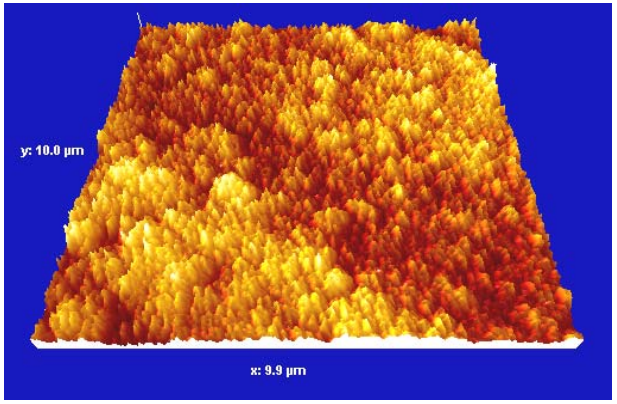
T. V. Shahbazyan, W. L. Walters, F. Hagelberg, Jackson State University, DMR-0407108

Surface Characterization of Thin Films and Coatings using AFM and STM:

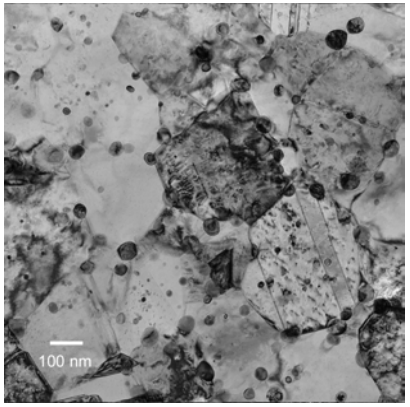
- The aerospace and microelectronics demand materials with high thermal conductivities and moderate strengths at high temperatures. The search for novel thin films and coatings has sparked interests in nanostructured materials, and in particular Cu-W alloys.

- These alloys take advantage of the high electrical conductivity associated with Cu and the strengthening capabilities of refractory metal alloys, such as tungsten at high temperature.

- Research on Cu-W alloys has revealed that these alloys can be created using sputter deposition. These nanostructured materials have been shown to remain stable with sizes below 100 nm at temperatures as high as 900°C for up to 100 hours. Mechanical hardness values reveal strengths several times that of similarly processed Cu films.



AFM image of surface of a sputter deposited a $Cu_{97}W_3$ alloy annealed at 900°C for 100 hours.



Bright field TEM image of a sputter deposited $Cu_{97}W_3$ alloy annealed at 900°C for 100 hours revealing tungsten nanoparticles within Cu matrix.

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Nanotechnology Undergraduate Education and Outreach:

- An introductory Nanotechnology course has been offered at Jackson State University during Spring and Fall 2004 semesters, with an accompanying laboratory course to follow. The course is descriptive and interdisciplinary in nature and is designed to increase student awareness of advanced technologies such as nanotechnology, develop research skills along with necessary presentation and technical skills.

- Currently 11 students from various departments (Biology, Physics, Civil Engineering, Computer Engineering, Computer Science and Chemistry) are involved in nanostructured materials research. These include AFM and STM characterization of metal, polymer and ceramic thin film coatings for applications related to microelectronics, biomedical and biosensing devices. These activities resulted in student presentations at four conferences. All students participated in summer research initiatives which included research sites at JSU, Cornell University, Lawrence Livermore National Laboratory and Northrop Grumman.

- A Nanotechnology Seminar series has been established which has included speakers from Jackson State University, University of Florida, NIST, Florida A&M University, and the Mississippi Technology Alliance.

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