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13. ABSTRACT (Maximum 200 words)

The instrumentation funds of this grant were used to upgrade an NEC 5SDH-2 high energy implanter with a an upgraded gas stripper chamber, insulating gas transfer system, and residual gas analyzer. These upgrades improve ion beam current, reduce repair and maintenance costs and downtime. The Eaton low energy implanted was provided with new vacuum pumps to replace irreparable pumps. This implanter will allow materials modification by low energy, high current ion beams at AAMU, rather than at other facilities. Funds were also use to acquire a micro-Raman spectrometer (DILOR LabRam) and an optical spectrophotometer (Spectral Instruments). These instruments analyze materials modified by ion beams, created by in-house deposition s systems or provided by customers. Funds were also expended to purchase a guass meter probe for the ion selection magnet on the high energy implanter and a near infrared viewer for use in analyzing ion beam modified channel waveguides.

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FINAL TECHNICAL REPORT

Grant: F49620-98-1-0497

Title: Materials Research Science and Engineering Center

PI: Daryush Ila

Institution: Alabama A&M University, Normal, AL

The materials researchers at Alabama A&M University (AAMU) teamed to form the "AAMU Materials Research Science and Engineering Center" to respond to the needs of high tech industries and the Ph.D. program in Materials Physics/Sciences at AAMU. The primary objective of this proposal was to improve and advance the infrastructure of materials processing and characterization research at AAMU as well as to boost AAMU's existing Ph.D. program in Materials and Optics. The establishment of such educational and user oriented center increased collaboration with industries, government agencies and other universities, and acts as a vehicle to advance high tech industries in Alabama, attract new ones and improve the research infrastructure at AAMU.

The foundation of this user facility is the existing expertise and instrumentation. The list of the available instrumentation would take several pages, but included is a list of the major instrumentation which are: low and high energy ion implanters, Rutherford Backscattering Spectrometry, Proton Micro-Probe, Scanning Electron Microscope, X-ray diffraction system, thermal analysis systems, a variety of crystal growing systems, high temperature ovens (up to 3000°C), and a variety of fast laser spectroscopy systems. This project will help to bring together the existing expertise and capabilities as a core for the center. It will provide the needed infrastructure manpower support to start the operation of the "Materials Research Science and Engineering Center". It will facilitate the establishment of a User Laboratory within the same center and of some needed infrastructure instrumentation.

The awarded grant was for instrumentation only. In support of the above objectives the following equipment was acquired or upgraded:

For the high energy MeV implanter:

- a) Upgrade of the stripper chamber in the NEC 5SDH-2 accelerator, on-site assembly and testing
- b) SF₆ gas transfer for the NEC 5SDH-2 accelerator, including compressor and storage vessel.
- c) Residual Gas Analyzer (RGA)

These three improvements allow high beam currents and facilitate routine maintenance of the accelerator (as well as unscheduled repair) and improve and ease operation of the accelerator. The upgraded stripper chamber improves the system used to converted negative ions to positive ions in the accelerating column and improves beam throughput. The gas transfer system allows the SF₆ insulating gas to be reused rather than replaced, greatly reducing expense (and waste) during repairs. The RGA monitors molecules at the source, allowing the operator to quickly

select the proper ions for acceleration. The RGA system also is used to monitor the quality of the vacuum near the ion source.

For the low energy Eaton 200NV implanter new vacuum pumps were purchased to replace irreparable pumps. This low energy implanter will allow for a wider range of materials processing at AAMU; work that is currently performed off site.

Other equipment:

The other major pieces of equipment purchased under this grant were:

1) A micro-Raman spectrometer. This is a Raman spectrometer that operates through a microscope. It has been used extensively for analysis of ion implantation damage and recovery and identification of composite materials produced by the Ion Beam Assisted Deposition (IBAD) system. It has also helped in acquiring new customers for materials analysis.

2) An optical spectrophotometer. This UV-Vis spectrophotometer is used primarily in nano-cluster research wherein small metallic clusters are analyzed by their characteristic optical absorption peaks. It will also be used in a NASA project to monitor the quality of a bath used for electrodeposition of Ni and Co.

In support of this proposal, AAMU has devoted over 4000 square feet of laboratory space in the newly renovated Howard J. Foster Building exclusively to this project and to the multipurpose instrumentation funded by this project. Several industries are presently using the existing instrumentation at AAMU. Industries and government agencies which have shown interest in such services are Nichols Research Corp., Wiley Labs, U.S. Steel, Birmingham Steel, TRICO Steel, Hanna Steel, Citation Corporation, ACIPCO, U.S. Army Engineering Center, USSDC, MICOM, and NASA Marshall Space Flight Center. The ARO funds were used for instrumentation.

A complete list of equipment purchased under this grant is attached.

Equipment report

1.

Item	Manufacturer	Cost
Upgrade of stripper chamber in NEC 5SDH-2 accelerator, assembled and tested on site	National Electrostatics Corp.	58,574
SF6 gas transfer for NEC 5SDH-2 accelerator, including compressor and storage vessel	National Electrostatics Corp.	27,470
UV-Vis CCD based fiber optic spectrophotometer	Spectral Instruments	6,812
Gaussmeter probe	F. W. Bell	1,081.18
Infrared viewer(demo model)	Electrophysics	1,402
Vacuum pumps	Varian	37,280.5
Vacuum gauge controller	Varian	3,382
DILOR LabRam micro-Raman system	Instruments S.A. (now JY-Horiba)	116,806.5
Residual Gas Analyzer	Ferran Scientific	4,015.2
Additional costs of implanter upgrade	National Electrostatics Corp.	3,209.73
LabView	V.I. Control	3,835
Vacuum pump	Pfeiffer	5,844
Cryo compressor test	APD Cryogenics	495
Vacuum components	Duniway stockroom	2,738.25
Vacuum pump	Leybold Vacuum	6,500
Vacuum pump repair	Leybold Vacuum	5,232.73
1700°C furnace, partial payment	Bid Service	1,185.88
Equipment case	Atlantic Video	265.02
Computer parts	Madison Books and Computers	346
	Total	286,474.99