Depth Profile and Bulk Analysis of NASA LDEF Samples using Glow Discharge-Atomic Emission Spectroscopy

Dave Jedrejcic*, Janet Adair*, Douglas L. Harper
Department of Physics and Astronomy
Western Kentucky University

From April 1984 to January 1990 NASA’s Long Duration Exposure Facility (LDEF) satellite orbited the earth exposing approximately 10,000 samples to the environment in low-earth orbit. Several experiments using these LDEF samples have been and are still being carried out by various government, industrial, and university laboratories. The aim of these experiments is to investigate the effects of long-term exposure of spacecraft materials and components to the ambient environment of low-earth orbit.

We are beginning a project in which we are making a detailed analysis of the concentration of contaminants on and just below the surfaces of various LDEF samples using a glow discharge-atomic emission spectrometer (GD-AES). This instrument provides accurate characterization of the concentrations of elements as a function of depth into the sample. The GD-AES system used in our studies employs a Grimm-type glow-discharge lamp and a 0.4 meter Rowland circle vacuum monochromator. The system is fitted with 28 photomultiplier tubes that allow simultaneous analysis of 26 elements. The emission intensities of atoms sputtered from the surface by the argon plasma are recorded versus time providing immediate qualitative elemental analysis. Calibration of the GD-AES system using appropriate standards with known sputtering rates allows one to do quantitative depth profile and bulk analysis. By using a rf lamp both conducting and insulating samples can be analyzed.

Preliminary results from this project will be discussed.

The authors wish to thank the Kentucky NASA/EPSCoR Research Enhancement Grant Program and the LECO Corporation for financial support of this work.