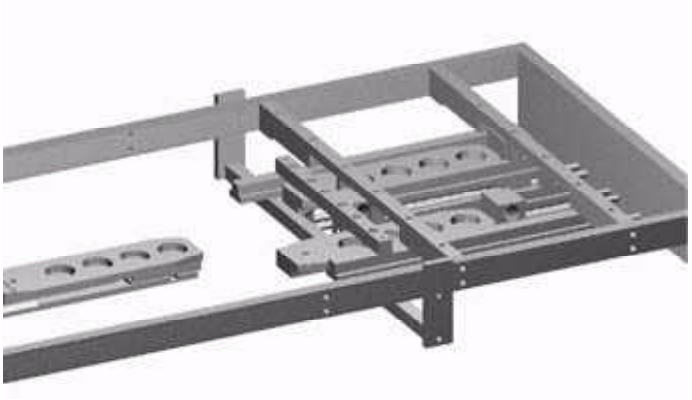
Automated Multiple-Sample Tray Manipulation Designed and Fabricated for Atomic Oxygen Facility

Extensive improvements to increase testing capacity and flexibility and to automate the in situ Reflectance Measurement System (RMS) are in progress at the Electro-Physics Branch's Atomic Oxygen (AO) beam facility of the NASA Glenn Research Center at Lewis Field. These improvements will triple the system's capacity while placing a significant portion of the testing cycle under computer control for added reliability, repeatability, and ease of use.

The AO facility's electron-cyclotron resonance plasma source generates a low-energy AO beam with a total effective flux that can be set between 1×10^{15} and 2×10^{16} atoms/cm^2/sec. Simultaneous vacuum ultraviolet radiation exposure is provided by deuterium lamps that yield radiation intensity levels of three to five equivalent Suns in the 115- to 200-nm range. Total hemispherical spectral reflectance of samples can be measured in the wavelength range from 250 to 2500 nm. A three-axis positioning system, composed of two linear stages and one rotary stage, is used to position a single sample tray, containing four samples, under the AO beam and to rotate the tray to extend it into the RMS.

Overall sample capacity is being tripled by the design and installation of a tray holder assembly that can hold up to three sample trays under the AO beam. The existing positioning system is being modified with an extension arm that can combine linear and rotary motions to pick any of the sample trays under the AO beam and bring it into the RMS. The sample tray can then be returned to the holder assembly for further exposure. In addition, the assembly has been designed so that two sample tray "ports" that are shielded from AO exposure can be added. This will allow a variety of exposure times to be used for different samples within the same test.



Multiple sample trays in tray holder assembly.

A movable sensor holder installed adjacent to each sample tray will provide for easy in situ

characterization of the deuterium lamp performance. It can be positioned at any sample location for sample-specific vacuum ultraviolet radiation exposure levels.

The RMS makes use of a sliding stage containing two detectors and a sliding stage containing a reference material sample. These two stages were previously positioned with manual linear feedthroughs. With these feedthroughs, a stage could block the path of a sample tray that was being extended into the RMS. This system is being modified to include two motor-driven rotary feedthroughs connected to lead screw assemblies that translate the stages along linear bearing pathways, avoiding this potential problem.

A computer program is being developed to automate all sample tray pickup and placement operations, RMS stage positioning, and any required data acquisition. System conditions will be monitored for quality and safety, and a graphical interface will show the real-time positions of all sample trays.

For more information, visit the Electro-Physics Branch
http://www.grc.nasa.gov/WWW/epbranch/ephome.htm.

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