5 eV Atomic Oxygen Damage to Low Earth Orbit Optical Components	X24C

J.C. Rife (NRL)

We have initiated a study of the effects of 5 eV atomic oxygen (ATOX) bombardment on ultraviolet and soft x-ray optical surfaces. Typical ATOX fluxes for low earth missions such as the shuttle and satellite observatories are 10^{20} to 10^{22} atoms/cm^2-year in the ram direction. ATOX bombardment affects the top surface layers, and is not energetic enough to sputter practically all materials. However, ATOX can quickly erode hydrocarbon compounds and coatings such as osmium that form volatile oxides and can also alter the oxide layers and the surface condition of other materials.

We have measured the reflectance of silicon and fused silica as well as Mo/Si, W/Si, W/B_4C, and W/C multilayers before and after an ATOX dose of 10^{20} atoms/cm^2. Fig. 1 shows the 5 degree grazing reflectance at the oxygen K edge of bulk SiO_2, a silicon wafer with typical native SiO_2 overlayer 1 nm thick, and an equivalent silicon wafer exposed to ATOX. Changes in the absorption edge structure of the dosed wafer indicate an increase in oxide thickness and an admixture of oxygen-oxygen bonds and other bonding states in the damaged oxide.

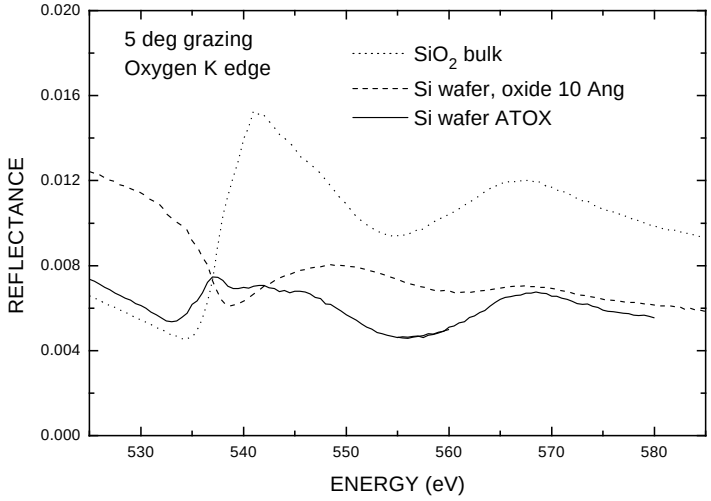

Figure 1.