SIMULATION OF SPACE WEATHERING: INSTRUMENTATIONAL DEVELOPMENT. M. Yesiltas[1], J. Thieme[2], N. Simos[2], and T. D. Glotch[1], [1]Department of Geosicenes, Stony Brook University, 255 Earth and Space Sciences Building, Stony Brook, NY, 11794-2100. (mehmet.yesiltas@stonybrook.edu), [2] Brookhaven National Laboratory, PO Box 5000 Upton, NY 11973-5000.

Introduction: Surfaces of airless bodies continuously interact with the space environment, and as a result, such surfaces are altered in various ways including chemical and physical alteration [1]. The primary agents of this alteration are solar wind and micrometeorite bombardment, each of which may break molecular bonds, form new molecules, or change elemental composition [2]. For instance, these space weathering processes create nano-phase metallic iron within amorphous silicates [3], which causes their spectral properties to be darkened and/or reddened [4], creating discrepancies between remote sensing data and spectra of laboratory analogs such as meteorites.

Methods: Here we present our experimental design for simulating space weathering in the laboratory and analyzing the spectral and chemical changes in our samples *in situ*. The experiment is being installed at the Brookhaven National Laboratory (BNL), where a sample stage will be placed in a custom-built portable vacuum chamber (Fig. 1). Once at vacuum, the sample chamber will be brought to BNL's Tandem negative ion source for H- irradiation. Each sample will be irradiated with H- ions from 10 to 100 keV to provide a range of ion penetration depths in samples. Throughout the irradiation process, we will acquire VNIR spectra between 350 - 2500 nm using an ASD Fieldspec3 Max spectrometer, which will be coupled to the vacuum chamber.

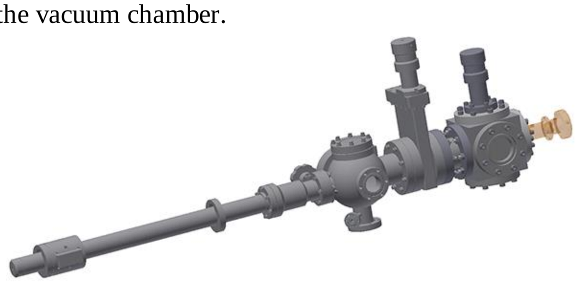

Figure 1. Model design of the vacuum chamber.

Subsequent to H- ion irradiation and spectral characterization in the infrared, our mineral and meteorite samples will be transported across the BNL campus to the National Synchrotron Light Source II (NSLSII) Sub-micron Resolution X-ray Spectroscopy beamline (SRX). At SRX, both H- irradiated and pristine samples will additionally be irradiated with a nanosecond pulsed laser which allows irradiation between 400 – 2500 nm. Compositional changes will be monitored in real time with VNIR reflectance spectroscopy and synchrotron X-ray spectroscopy. Namely, we will acquire VNIR spectra of each sample after each laser shot, after which we will also interrogate each sample using the SRX beamline to assess changes in sample structure and chemistry at sub-micron scales with high spatial resolution (~50 nm). This information will also help us map the spatial distribution of specific elements present within the samples.

Two agents of space weathering, solar wind sputtering by (and, perhaps, implantation of) hydrogen atoms and micrometeorite bombardment, lead to the maturation of the surfaces of airless bodies. While the former leads to the formation of nanophase metallic iron blobs, the latter leads to the formation of agglutinitic glass and a reduced vapor-deposited coating [3,5,6].

Our high resolution *in-situ* experiments on various minerals and meteorites will help us further understand effects of space weathering due to solar wind and micrometeorite bombardment on the exposed surfaces of airless bodies. We will be able to investigate the structural and geochemical changes associated with space weathering, as the process is occurring, using the SRX beamline of NSLSII in order to conduct detailed X-ray spectroscopy studies of samples at sub-100 nm spatial scales

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