NANOIMAGING OF NANOSTRUCTURED METAL RICH ORDINARY CHONDRITES AT DIFFERENT WAVELENGHTS. E. Palomba[1], A. Longobardo[1], M. Girasole[2], G. Longo[2], G. Pompeo[2], A. Cricenti[2] and P. Gori[2]. [1]IFSI-INAF, via Fosso del Cavaliere 100, Rome. E-mail: ernesto.palomba@ifsi-roma.inaf.it [2]ISM-CNR, via Fosso del Cavaliere 100, Rome.

Introduction: Space Weathering (SW) is an ensemble of processes that act on a body exposed to space environment. One of SW effects is the development and accumulation of iron nanoparticles (npFe) on the asteroid surface. In fact, according the most qualified scenario, npFe are produced by shock-induced phase transformation of Fe-Ni alloys caused by micro-collisions [1]. These npFe are responsible for the reddening in the asteroids, i.e. the increase of IR reflectance with increasing wavelength, observed through infrared remote sensing measures. This reddening is not observed in spectra of Ordinary Chondrites, whose parent bodies are S-type asteroids, and this confirms that the phenomenon is linked to SW.

Nanoimaging studies and simulations: To clarify the role of iron phase transformation in the SW of asteroid surfaces, we applied the SNOM (Scanning Near Field Optical Microscopy) technique to study an Ordinary Chondrite (OC) rich in martensite. In the SNOM technique, a light beam is passed through an optical fiber, that ends in a tip. Tip width is smaller than light wavelength: in this way light passing through the aperture is confined by the dimension of the tip and hence a high spatial resolution (hundreds of nanometers) is obtained [2]. Sample, whose dimensions are of micron order, is placed near the tip, in such a way that radiation emerging to the tip is forced to interact with it before diffracting out. Applying this nanoimaging technique, it's possible to retrieve a reflectivity image and a topographic image of the sample. The reflectivity image could show differences due to chemistry, that is the case when we observe two different mineral phases such as a silicate or a cloud of iron nanoparticles. In principle, the different chemistry will be evidenced by comparing reflectivity images taken at different wavelengths when spectral absorption bands are present.

In order to better understand the SNOM images, discerning the different effects (e.g. topography vs. chemistry), laboratory analysis is supported by a software that simulates the interaction between the electromagnetic wave and the sample, allowing to calculate the electromagnetic field distribution in 3D and the electromagnetic energy transmitted and reflected by the sample. Electric and magnetic energy distribution in 3D space is obtained by resolving the Maxwell Equations, through a Transient Solver (that is a variant of Finite Integration Technique).

Preliminary Results: SNOM images of OC areas rich in npFe were taken at 900 and 1300 nm, where for olivine spectral absorption bands are present or absent, respectively. At the same wavelengths, first synthetic images of samples of olivine with and without presence of npFe were produced. The analysis and comparison of the synthetic and the SNOM images are currently in progress.

References:

[1] Moretti, P. F. et al, 2005. Detection of nano-structured metal in meteorites: implications for the reddening of asteroids. *ApJ* **634**, L117-120. [2] Dunn, R. C., 1999. Near-Field Scanning Optical Microscopy. *Chem. Rev., 99,* 2891-2927.