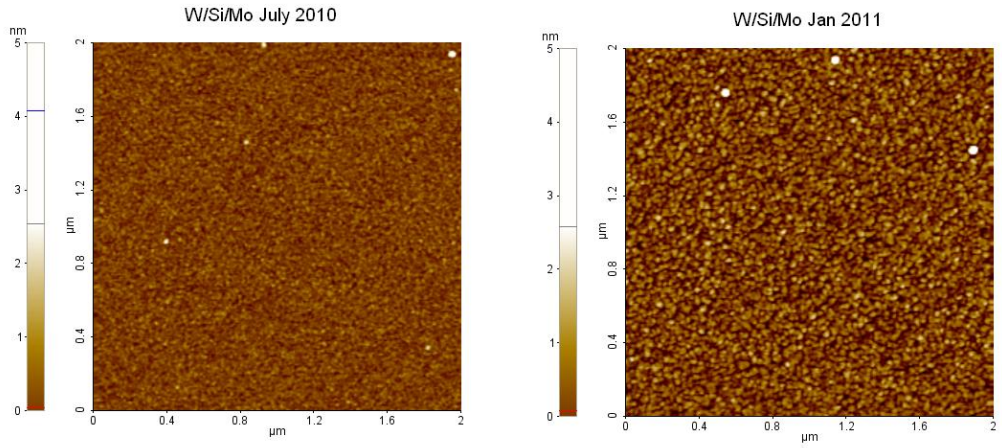

Fig. 6. AFM analysis of CL4 after deposition and six months later

5. Conclusion

A variety of capped Mo/Si multilayers have been designed for improved performance at 30.4 nm wavelength.. The choice of considering MLs based on Mo/Si bilayers is related to the proven high reliability of these films on the long term. Different capping layers are used to enhance reflectance at 30.4 nm. Multilayer based on other material couples could in principle provide higher reflectance at 30.4 nm, but their stability validation is still required for space instruments application. Reflectance measurements of prototype films were made at 30.4 nm (He II) and121.6 nm (H Ly alpha) wavelengths, and in the visible spectral range as well, in order to qualify these coatings as possible candidate for the METIS coronagraph on board of SOLar Orbiter. Reflectance measurements made over six months show excellent stability for 3 of the 4 prototypes investigated; temporal stability measurements over longer time scales are still needed, however. We find that Ru- and Ir-capped MLs show higher reflectance at 30.4 nm with respect to a standard periodic Mo/Si, while the W-capped ML is unstable over time. The reflectance values measured at 121.6 nm are lower in the capped MLs case than in the Mo/Si standard reference, but the performance sum still represents a good compromise considering that effective area at 30.4 nm is the main concern; in fact, due to the abundance of hydrogen in the solar corona, the HI Lyman-α line (121.6nm) is much brighter than the HeII Lyman-α line (30.4nm). On the other hand, we find an improvement of reflectance in the visible range. In particular, while from a structural point of view the use of a Mo interlayer in the Ir capped structures does not seem to have any impact in the performance at 30.4 nm and at 121.6 nm, its use allows to improve the performance in the visible spectral range; further analysis is required to verify possible effects of this inter-layer on long term stability. We propose these new coatings as useful for space application, for which superior performance in the EUV spectral range are required along with long-term temporal stability.

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