Superhydrophilic low temperature TiO_2 ultra thin films deposited on CSP mirrors by magnetron sputtering

N. Mouti*, A. Kaidatzis, K. Giannakopoulos
Institute of Nanoscience and Nanotechnology, N.C.S.R. "Demokritos", Athens, Greece

Soiling of mirrors increases concentrated solar thermal power (CSP) maintenance costs. Previous approaches with self cleaning coatings have failed to fully address the challenges posed by the surfaces' nature and interaction with their environment, such as desert dust [1]. During the present work, we prepare by magnetron sputtering and characterize TiO_2 thin films on Guardian Glass CSP mirrors [2] , in order to take advantage of their superhydrophilic self cleaning character. Hydrophilicity has been shown to be a purely surface property after being tested in a variety of film thicknesses. We report here results from thin films of various thicknesses, the best of which was at about 8 nm, with uniform and stable mirror coverage, as seen in optical profilometry. Aiming at low deposition temperatures for fabrication cost reasons, we managed to reach 120º C. The contact angle we achieved was <1º, without the UV treatment that is usually needed. Because maximum mirror reflectivity is also a major requirement, we achieved up to 100 percent film transmission, as the O_2 during the sputtering process increases and the thin film's thickness decreases [1]. The superhydrophilic property and transmittance measurements of representative samples are shown below.

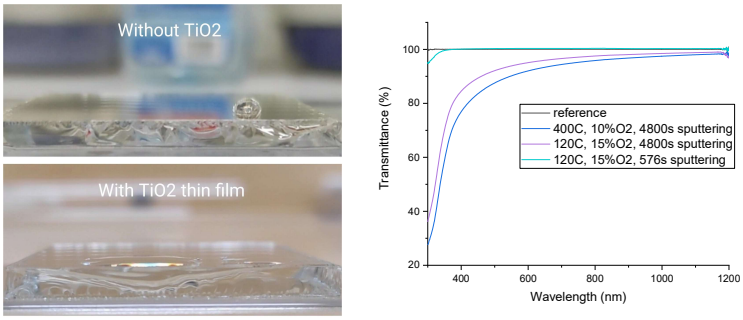

Figure 1: Demonstration of CSP mirror hydrophilicity before and after the sputtered deposition TiO_2 thin film. Transmittance UV-IR measurements of TiO_2 sputtered films.

References

[1] P. Bellmann, F. Wolfertstetter, R. Conceição, and H. G. Silva, Sol. Energy **197**, 229–237 (2020)

[2] M.-K. Lee and Y.-C. Park, Thin Solid Films **638**, 9–16 (2017)

Acknowledgements

Project Nano4CSP is supported under the umbrella of SOLAR-ERA.NET Cofund 2 by GSRT – General Secretariat for Research and Development (Greece), RIF – Research and Innovation Foundation (Cyprus) and FFG – Austrian Research Promotion Agency. SOLAR-ERA.NET is supported by the European Commission within the EU Framework Programme for Research and Innovation HORIZON 2020 (Cofund ERA-NET Action, N° 786483)

* n.mouti@inn.demokritos.gr