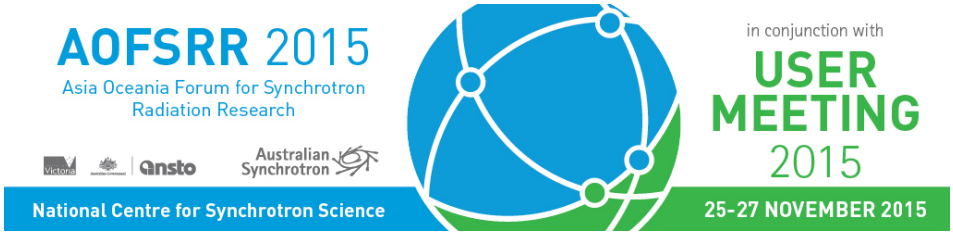

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Silica nanoparticles acting as light nanocondensers

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The development of functional nanocoating is crucial in the manufacturing process, possessing the potential to increase both surface corrosion and deterioration resistance properties. In particular, silica nanoparticle (SiO2 NP) coatings have been widely used to increase corrosion-, wear- and tear-resistance. For instance, in industrial applications, steel surfaces are initially coated with polyester polymers and then further coated with SiO2 NPs. However, the effect of environmental factors upon these dual protection layers pertaining to steel substrata still remains unknown. In this study, we employed various surface characterization techniques to ascertain both the physical and chemical properties of SiO2 NP-coatings on a polyester-coated steel substratum. The modified substrata were exposed to hot and humid environments with high levels of UV-light irradiation over a period of five years. It is found that surfaces coated with SiO2 NPs, lead to an increased surface roughness on the nano-scale, as inferred from atomic force microscopy and optical profilometry. The rate at which surface roughness increased was found to be five times greater than that of substrata without SiO2 NP coatings. Furthermore, chemical characterization of SiO2 NPs-coated steel substrata was performed using X-ray photoelectron spectroscopy and synchrotron IR micro-spectroscopy. Despite coating degradation, SiO2 NPs were found to be present on the surfaces. One innovative mechanism proposed in this study, is that SiO2 NPs act as light nanocondensers, enhancing the UV-light effect upon the degradation of polymer-coating between SiO2 NPs.

Keywords

light nanocondensers, silica nanoparticles, functional nanocoating, UV-light effect

Primary author(s) : Prof. IVANOVA, Elena P. (School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology, Hawthorn, Vic, Australia, 3122); Dr TOBIN, Mark (Australian Synchrotron); Mr STEFANOVIC, Miljan (School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology, Hawthorn, Vic, Australia, 3122); Prof. CRAWFORD, Russell J. (School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology, Hawthorn, Vic, Australia, 3122); Dr MACLAUGHLIN, Shane (BlueScope Steel Research, Port Kembla, NSW, Australia); Dr TRUONG, Vi Khanh (School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology)

Presenter(s) : Prof. IVANOVA, Elena P. (School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology, Hawthorn, Vic, Australia, 3122); Mr STEFANOVIC, Miljan (School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology, Hawthorn, Vic, Australia, 3122); Dr TRUONG, Vi Khanh (School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology)

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