This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 101035813

Photocatalytic Thermoplastic Coatings Layered onto Cement Surfaces for Gaseous Pollutants Abatement

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In contemporary times, photocatalytic remediation has emerged as a promising and sustainable strategy to mitigate xenobiotic volatile organic compounds (VOCs) pollutants in the atmosphere. This perspective has led to the integration of photocatalysis within the construction industry. Specifically, the incorporation of titanium dioxide nanoparticles (TiO_2 NPs) in cementitious matrices has been used in recent years, raising concerns regarding the environmental release of the photocatalyst through leaching and its notable wastage. Moreover, only nanoparticles exposed on the cement surface exhibit photocatalytic properties[1]. In the last years, our research group has developed a novel synthetic approach involving a bulk radical polymerization performed into the photocatalyst nanoparticles[2], avoiding self-aggregation phenomena and enhancing light conveyance into the photocatalyst[3].

This communication presents the photocatalytic performances and behaviours of PMMA-based[4] nanocomposites containing metal oxides, layered as thin films on cement surfaces to simulate real-world applications. Photocatalytic experiments were carried out with a simulated solar light source, using toluene as a VOC model pollutant, and monitoring the oxidation products through an online GC apparatus. Experiments evidenced a significant performance of the PMMA-TiO_2-SiC system over the other nanocomposites, with synergistic effects observed in multi-oxide systems, compared to individual oxide counterparts.

Finally, the photocatalytic activities of the nanocomposites were compared with existing TiO_2-based photocatalytic systems used in the building industry, showing superior performance.

The experimental results contribute to the research on efficient photocatalytic systems for air pollution abatement, emphasizing the importance of new polymeric-based materials in the building construction field.

This work was partially financed by "PON FSE REACT-EU 2014–2020 Azione IV-6".

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