World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:16, No:04, 2022

Preparation of Novel Silicone/Graphene-based Nanostructured Surfaces as Fouling Release Coatings

Authors : Mohamed S. Selim, Nesreen A. Fatthallah, Shimaa A. Higazy, Zhifeng Hao, Ping Jing Mo

Abstract : As marine fouling-release (FR) surfaces, two new superhydrophobic nanocomposite series of polydimethylsiloxane (PDMS) loaded with reduced graphene oxide (RGO) and graphene oxide/boehmite nanorods (GO-γ-AlOOH) nanofillers were created. The self-cleaning and antifouling capabilities were modified by controlling the nanofillers' shapes and distribution in the silicone matrix. With an average diameter of 10-20 nm and a length of 200 nm, γ-AlOOH nanorods showed a single crystallinity. RGO was made using a hydrothermal process, whereas GO-γ-AlOOH nanocomposites were made using a chemical deposition method for use as fouling-release coating materials. These nanofillers were disseminated in the silicone matrix using the solution casting method to explore the synergetic effects of graphene-based materials on the surface, mechanical, and FR characteristics. Water contact angle (WCA), scanning electron, and atomic force microscopes were used to investigate the surface's hydrophobicity and antifouling capabilities (SEM and AFM). The roughness, superhydrophobicity, and surface mechanical characteristics of coatings all increased the homogeneity of the nanocomposite dispersion. To examine the antifouling effects of the coating systems, laboratory tests were conducted for 30 days using specified bacteria.PDMS/GO-γ-AlOOH nanorod composite demonstrated superior antibacterial efficacy against several bacterial strains than PDMS/RGO nanocomposite. The high surface area and stabilizing effects of the GO-γ-AlOOH hybrid nanofillers are to blame for this. The biodegradability percentage of the PDMS/GO-γ-AlOOH nanorod composite (3 wt.%) was the lowest (1.6%), while the microbial endurability percentages for gram-positive, gram-negative, and fungi were 86.42%, 97.94%, and 85.97%, respectively. The homogeneity of the GO-γ-AlOOH (3 wt.%) dispersion, which had a WCA of 151° and a rough surface, was the most profound superhydrophobic antifouling nanostructured coating.

Keywords : superhydrophobic nanocomposite, fouling release, nanofillers, surface coating
Conference Title : ICHMN 2022 : International Conference on Hybrid Materials and Nanomaterials
Conference Location : London, United Kingdom
Conference Dates : April 21-22, 2022