

Cross-Linking of PVA-Based Coatings for Antifouling Applications

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Under IMO regulations, antifouling materials for marine applications are deemed necessary for the protection of aquatic environments and for the reduction of fuel consumption in shipping.^{1,2} Cross-linked poly(vinyl alcohol) (PVA) based films can offer antifouling properties due to its hydrophilicity, by creating a water barrier that can block protein physisorption deriving from intermolecular interactions.³ In this study instead of standard cross-linking agents such as glutaraldehyde that might show toxicity when degraded⁴, polyoxometalates (POM's), well known for their attractive redox properties, were investigated. Photo-patternable, PVA/POM films spin coated on silicon wafers were investigated and it was demonstrated that they can effectively hinder protein physisorption. The PVA/POM films were cross-linked under UV radiation by Diels-Alder reactions.³ Different molecular weights and different hydrolysis percentages of commercially available PVA influenced the required processing conditions including post-applied (PAB) and post-exposure baking (PEB) temperatures as well as UV exposure dosage. Results showed that PVA with higher molecular weight required lower temperature processing. The research aims to develop new cross-linking agents for PVA films with effective antifouling properties, suitable for large-scale applications, including in the marine industry.

[1] Katherine A. Dafforn; John A. Lewis; Emma L. Johnston, *Mar. Pollut. Bull.*, 62,453-465 (2011)

[2] International Maritime Organization Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive species (AFS.3-Circ.3-Rev.1) (2020).

[3] P.Pavli; P.S. Petrou; A.M. Douvas; E. Makarona; S. Kakabakos; D. Dimotikali; P. Argitis, *Procedia Eng.*, 25, 292 – 295 (2011)

[4] Pal, Kunal, Allan T. Paulson, and Dérick Rousseau, *Handbook of Biopolymers and Biodegradable Plastics*, Elsevier, 330-352 (2013)