Hexagonal boron nitride-reinforced polyisobutylene-based anticorrosive coatings

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The incorporation of inorganic nanofillers into polymeric matrices represents an effective strategy for developing smart coatings for corrosion protection [1,2]. In this work, we investigate the addition of hexagonal boron nitride (*h*-BN) flakes, produced through the wet jet milling method in BeDimensional SpA industrial plant [3,4], as functional anticorrosive filler into polymeric polyisobutylene (PIB) matrix to yield *h*-BN/PIB composites with different *h*-BN contents. Once casted onto structural steel substrates, the anticorrosion properties of the as-produced composites were evaluated in a 3.5 wt.% NaCl aqueous solution, following ASTM standards. The results demonstrate that the *h*-BN/PIB composite with an *h*-BN content of 5 wt.% is the most performant anticorrosive coating, exhibiting a corrosion rate that is two orders of magnitude lower compared to the one of the pristine PIB coating used as reference (7.42×10^{-6} mm year^{-1} *versus* 4.47×10^{-4} mm year^{-1}), see Figure 1. Our composite coating maintained its corrosion protection efficiency over 1000 h of continuous immersion in saline water, resulting in an ideal long-term anticorrosion coating for steel operating in corrosive marine environments. The hydrophobic nature of the *h*-BN flakes, together with the capability of PIB to act as a moisture barrier, are the reasons behind the remarkable anticorrosion performance.

References

[1] G. Cui *et al*, Prog. Org. Coatings. 148 (2020) 105821.
[2] A. Kausar, J. Plast. Film Sheeting. 35 (2019) 181.
[3] A. E. del Rio Castillo *et al*, Mater. Horizons. 5 (2018) 890.
[4] A.E. Del Rio Castillo, A. Ansaldo, V. Pellegrini, F. Bonaccorso, WO 2017/089987 Al, 2019.

Figures

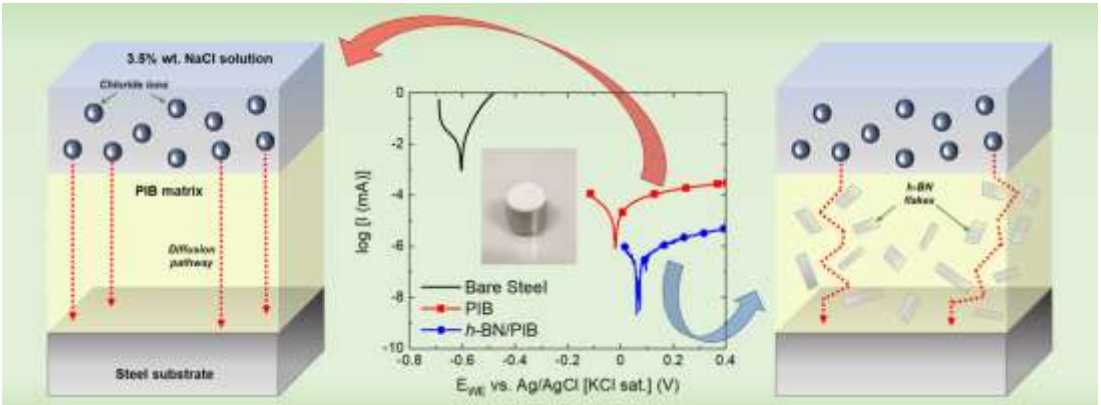

Figure 1: *Anodic polarisation curves (Tafel plots) of pristine PIB- and h-BN/PIB composite-coated structural steel. The Tafel plot measured for uncoated structural steel is also shown for comparison. The figure also shows schematic diagrams of diffusion pathways followed by chloride ions through pristine PIB and h-BN/PIB composite coatings from the NaCl aqueous solution to the surface of the steel substrate.*

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