Hexagonal boron nitride-based anticorrosion protective systems

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The development of advanced protective systems [1] is demanded to enable substantial progresses in a wide range of applications [2]. Among the different polymers investigated as anticorrosion coatings [3], polyisobutylene (PIB) is one of the most promising due to its capacity to act as a physical barrier against moisture [4]. In this work, we demonstrate that the addition of liquid phase exfoliated hexagonal-boron nitride (*h*-BN) flakes [5] into the polymeric PIB-matrix, i.e., *h*-BN/PIB composite, improves the barrier properties compared to pristine PIB. Electrochemical measurements of *h*-BN/PIB composites with different *h*-BN contents have been carried out (Fig. a), yielding *h*-BN/PIB *5%* the best results with a corrosion rate as low as 6.8 x 10^{-6} mm $year^{-1}$. In addition, the presence of *h*-BN flakes in the polymeric matrix has shown to provide protection against harsh oxidative environments. The absorption spectra of pristine PIB and *h*-BN/PIB *5%* systems before and after being subjected to O_2 plasma treatment reveal a loss of transparency of PIB in the visible region due to oxidation (Fig. b). Nevertheless, in the case of the *h*-BN/PIB system the loss of transparency is reduced by 85.5% compared to pristine PIB, which suggests that *h*-BN plays a protective role under oxidative atmospheres. In summary, we demonstrate that the addition of *h*-BN flakes enhances the anticorrosion performance of PIB-based protection systems, increasing its stability during operation under aggressive environments.

References

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Figures

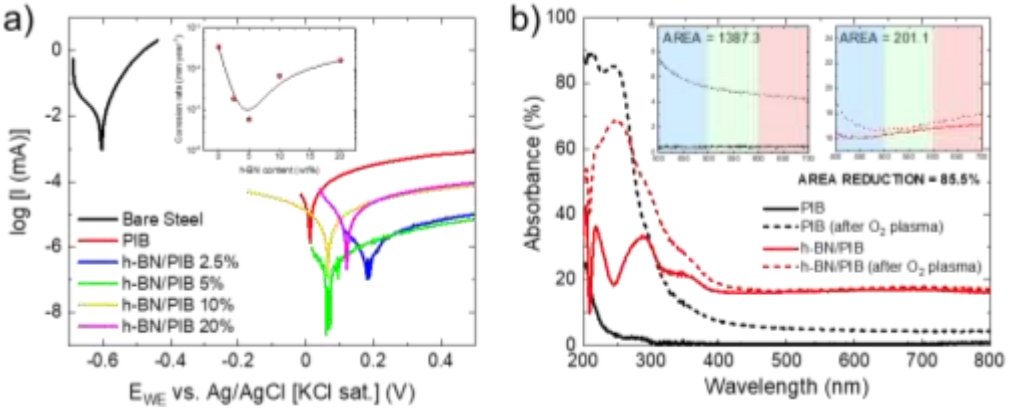

Figure: a) Tafel plots of the *h*-BN/PIB systems with different *h*-BN contents measured in a 3.5% NaCl aqueous solution (Inset: Calculated corrosion rate versus *h*-BN content). b) Absorbance measurements of PIB and *h*-BN/PIB systems before and after the application of the O_2 plasma treatment (Inset: Area calculation between the curves in the Vis region).

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