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Self-assembly of Hierarchical N-heterocycles-Inorganic Materials into Three-Dimensional

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ABSTRACT

Organic-inorganic materials based on porous inorganic materials predesigned hydrophobic multilayer coatings are well-established in the literature, but N-heterocyclic donor to prepare such flower-like structures with chemical bonds has not been reported to date. Here, organic-inorganic hybrid materials prepared by simultaneous coordination-driven assembly of heterocyclic molecules and porous materials are reported. Immersion porous inorganic film with 8-hydroxyquinoline (8-HQ) in ethanol solution leads, within a few days, to the formation of flowerlike organic-inorganic materials. Then, the organic layer grows on the inorganic surface, resulting in formation of charge transfer complex (Mgq_2 and Alq_3) between N-heterocycles and metal ions (Al^{+3} and Mg^{2+}). A spontaneous self-organization of these organic molecules is then triggered to form stable hierarchical N-heterocycles-inorganic materials, resulting from the non-covalent π - π bonds and inter-molecular hydrogen bonds between aromatic molecules. Finally, the electrochemical performance was enhanced in the order PEO-HQ4 (0.1 M 8-HQ for 2 days), PEO-HQ3 (0.05 M 8-HQ for 2 days), PEO-HQ2 (0.1 M 8-HQ for 1 day), PEO-HQ1 (0.05 M 8-HQ for 1 day), and PEO, which was discussed on the basis of polarization interpretation. The results indicate that magnesium film coated with the self-assembled 8-HQ/inorganic materials grown via plasma electrolytic oxidation and dip-chemical coating are corroded several times slower in an aerated NaCl solution as compared to the corrosion rate of bare magnesium.

KEYWORDS: magnesium alloy, N-heterocycles, inorganic materials, organic materials, hybrid, electrochemistry.

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