The effect of doping level on corrosive properties of polyaniline / polyvinylbutyral coatings

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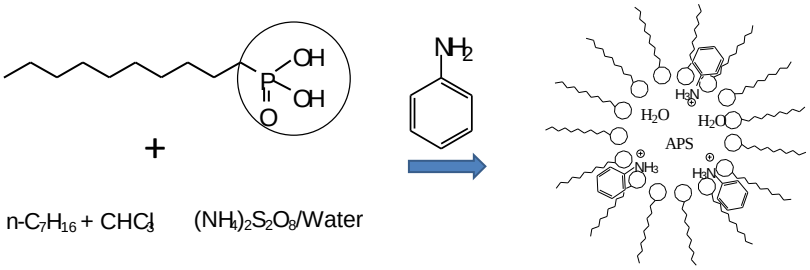
Polyaniline (PANI) was synthesized by using ammonium peroxodisulfate as an oxidant in reversed micellar solutions consisting of decylphosphonic acid (DPA) and water in a 2:1 mixture (v/v) of heptane and chloroform. We demonstrated the ability to tune the doping level and electrical conductivity of polyaniline by changing the surfactant:aniline ratio in the feed. Although DPA-PANI prepared in reversed micelle have shown a relatively poor crystallinity, the room temperature conductivity was 10^{-1}-2×10^{-1} S cm^{-1} which is a significant improvement compared to the conductivity of DPA reprotonated PANI base (2.3×10^{-4} S cm^{-1}). The PANi salt powder precipitated from its dispersion showed improved solubility in organic solvents. Such a processable DPA doped PANI was incorporated as pigment in a polyvinyl butyral (PVB) binder. The anticorrosive performance of the PVB resin loaded with 2 wt% of DPA PANI was tested on steel by exposure of the coated metal to neutral saline conditions (salt spray and immersion in 3.5% NaCl solution). The corrosion process was monitored by measuring the concentration of the iron ions released to the corrosive media and by electrochemical impedance spectrometry. The results demonstrated that the efficiency of protection increases with the doping level of DPA PANI pigments. The DPA PANI with the highest doping level resulted in the best protection efficiency which strongly supports an inhibitive action of DPA released from PANI (after its dedoping and/or its reduction to leucoemeraldine).



Optical photos of PVB loaded with 2wt% PANI at different doping level after 10 days immersion in 3.5 wt% NaCl solution

Doping level 21 % 33 % 38 %

(100xmolar ratio of (P+S) to phenyl-N repeat unit of PANI)