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Polyaniline-clay composite-containing epoxy coating with enhanced corrosion protection and mechanical properties

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#### ABSTRACT:

The corrosion of steel is a worldwide industrial problem. In this study, we demonstrate that polyaniline (PANI), an extensively studied additive for organic coatings that affords corrosion protection, can be imbedded in epoxy, as a pigment in a clay composite, to protect steel against corrosion. The PANI-clay composite was synthesized in situ by oxidative polymerization and the coating was formulated by dispersing PANI-clay composite particles were dissolved in (N-methyl pyrrolidone) NMP by ultra-sonication and then mixed into an epoxy resin using a wooden spatula. The addition of low levels of clay improved the BET (Brunauer-Emmett-Teller) surface area of PANI. Improved corrosion protection was observed through immersion testing and electrochemical studies; 33.4% of the surface of the neat epoxy coating was covered in rust, while only 19.3% of the epoxy composite surface was covered. Furthermore, electrochemical studies showed that the corrosion rate was reduced by the incorporation of the PANI-clay composite particles in epoxy resin, which exhibited a protection efficiency of 76.2%. The composite-containing epoxy film also exhibited superior mechanical properties. Therefore, the enhanced performance of the epoxy-based composite coating material makes it suitable for a wide range of applications.