PREFACE

In the quest for superior anti-corrosion solutions, this book introduces a groundbreaking approach that harnesses the power of zinc oxide (ZnO) and silica (SiO_2) nanoparticles. Addressing the limitations of existing coatings, the focus is on creating an innovative coating that overcomes challenges in adhesion and efficacy.

The synthesis of ZnO-SiO_2 nanoparticles through the sol-gel method takes center stage, alongside the meticulous preparation of coating samples. ZnO, chosen for its unique attributes including anti-corrosion, anti-bacterial, and exceptional heat resistance, collaborates with SiO_2 to enhance coating consistency, ensuring optimal adhesion and cost-effective flatting.

Among important aspect to be discussed in this book included single ZnO and single SiO_2 nanoparticle by sol-gel techniques with appropriate selection of parameters. Investigation on physical properties of ZnO-SiO_2 hybrid system and nanocoating as well as observation on the element and size of nanoparticles by XRD, TEM and nanoparticle analysis. The thermal properties of nanocoating particles are investigated through DSC, TGA analysis. The chemical bonding between nanoparticles and matrix is analyzed by FTIR and Raman test. Characterization of the adhesion properties of nanocoating and metal substrate is established by nanoeducator and adhesion test. Evaluation of corrosion properties of hybrid ZnO-SiO_2 nanocoating on carbon steel is examined by salt spray testing.

The formulations involve copolymerization of epoxy resin with the incorporation of ZnO and SiO_2 nanoparticles, where epoxy serves as the host and nanoparticles as crucial guest components. Applied directly

onto carbon steel type S50C, the resulting coatings undergo rigorous testing - adhesion, immersion, UV, humidity, and salt spray - adhering to ASTM standards (D3359, B895, D4587, D2247, and B117-94).

This book delves into the transformative impact of nanoparticles, revealing nanocoatings with enhanced thermal stability, improved cured epoxy coating quality, reduced porosity, and heightened barrier performance. The coatings exhibit robust adhesion in diverse mediums, forming hydrophobic surfaces and enduring prolonged protection in salt spray tests. Demonstrating remarkable anti-corrosion behavior and substantial thickness, these nanocoatings mark a paradigm shift in corrosion protection methodologies.

Norhasnidawani Johari
Yahaya Ramli
Siti Hamidah Setapar
Universiti Teknologi Malaysia

Noor Azlina Hassan
International Islamic University Malaysia
2024