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A review: New era of polymer based corrosion coatings

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Abstract
The review article reports the new materials like polymer based corrosion protection coatings. The various synthesis methods adopted by the researchers and characterization carried out for the confirmation of materials such as XRD, FTIR, UV-Vis, SEM, EDS, EIS, Cyclic Voltammetry (CV), potentiostatic and galvanostatic conditions are discussed. The various polymers and their copolymer as well as grapheme doped polymer are got tremendous anti-corrosion protection results which showing maximum 98% of efficiency.

Keywords: XRD, FTIR, UV-Vis, SEM, EDS, EIS, Cyclic Voltammetry (CV)

Introduction
Nowadays metals are basic content for the electronics devices, instruments, pipelines, construction, marine, aeronautics, automobiles industries, and machinery parts, etc. These metals things could be deteriorated due to corrosion and therefore they may require replacement which is very costly. Metal rods are the main structure in construction which placed inside the concrete, due to concrete it should be degrades that results in weak construction and decrease the service life of construction structure. Therefore, researchers got tremendous innovative research interest towards synthesizing the materials which can protect these important things from corrosion. The research for the development of anticorrosion materials is new era of research in both scientific and industry communities. Researchers are continuously trying to prepare the new and enhanced anticorrosion materials for better service life. Recently, polymers are main focus of research in anticorrosion materials due to they demonstrate good barrier properties, ease of altering properties and massive production. Also, polymer based anticorrosion materials have the properties like environment friendly nature, good environmental stability, good conductivity and low-cost production. Therefore, most of research is going on preparing the polymer based anticorrosion materials [1-11]. This review article is reports the research carried out regarding the synthesis and characterization of anti–corrosion materials based on polymer and their copolymer composites.

Results and discussions
The most researchers found the best results by synthesizing the polymer based anti-corrosion coating materials. Dagadag *et al*. synthesized and studied the polymer based epoxy resin TGEDA-MDA as effective anti-corrosive coating for steel. They found best results such as PDP reveals the anti-corrosion efficiency for the TGEDA-MDA near about of 93%. Moreover, EIS investigation reflects best results as effective anti-corrosive coating at metal-electrolyte interfaces for DGEDDS-MDA [7]. Rangel-Olivares *et al*. fabricated the nanocomposites of metal oxides (SiO_2, CeO_2, and TiO_2A) doped polyaniline through in situ chemical oxidative polymerization by rapid mixing and characterized via XRD, FTIR, UV-Vis, SEM, EDS, EIS. Results showed that TiO_2APANI/AR system, reveals excellent anti-corrosion protection of the steel as compared to other metal oxide based PANI nanocomposites. The TiO_2A/AR nanocomposites reveals the highest protection efficiencies with values 98.63 and 97.93%, SiO_2/AR nanocomposites reflects 97.35 and 97.52% and CeO_2-PANI/AR nanocomosites showed 94.28 and 90.96%. These results showed best efficiency for anti-corrosion of steel [12]. Zhang *et al*. prepared the novel carbon nanotubes of Layered double hydroxides (LDH-MoO_4) by using a facile in-situ growth method. The synthesized nanotubes are characterized via XRD, FTIR, UV-Vis, SEM, TEM, EDS, EIS.

They found best efficiency for anti-corrosion protection [13]. Mathew *et al*. Fabricated the styrene butadiene rubber/polyaniline (SBR/PANI) composites through the electro-polymerization method by using potentiostatic method. The obtained styrene butadiene rubber/polyaniline (SBR/PANI) composites materials represents the best anti-corrosion protection results in different media like acid and neutral media through the studies like Tafel polarization curves, OCP scan and EIS investigation [14]. Elhalawany *et al*. synthesized some conducting polymers nanoparticles (CPNs) such as poly anisidine (PAns), poly toluidine (PTol) and their copolymer (CCPNs) through mini-ia emulsion polymerization for anti-corrosion protection of metals and characterized via GPC, FTIR, TEM and DSC. They found that the presence of conducting polymers nanoparticles and conducting copolymers nanoparticles in the paint can be extremely improve the resistance quality of the formed paint films against corrosion, wash-ability and weathering effect [15]. Jadhav *et al*. synthesized Polypyrrole/Fe_2O_3 and PPy/Fe_3O_4 composites through iron electrochemically and it provide decent corrosion protection to mild steel [16]. Baldissera *et al*. prepared novel epoxy resin (EP)-based coating system containing polyaniline (PAni) as an anticorrosive agent for the corrosion protection of mild steel. The synthesized materials an EP/PAni-EB (emeraldine base), EP/PAni-ES (emeraldine salt), EP/SPAN (PAni sulfonated), EP/PAni-fibers, EP/PhoZn (zinc phosphate), EP/ChroZn (zinc chromate) or EP/Charge were coated on mild steel samples and investigated in 3.5% NaCl solution and found the best anti-corrosion effect [17]. Sathiyanarayanan *et al*. represents the corrosion protection performance of Polyaniline coating on stainless steel and investigated using Cyclic Voltammetry (CV), potentiostatic and galvanostatic conditions [18]. In this section we discussed on the research done by various researchers on the polymer based anti–corrosion materials which showed the best results for anticorrosion tests.

Conclusion

The polymers, conducting polymers, copolymers and their composites as well as nanocomposites represents the excellent results for corrosion protection directly as well as can be blend in the paint. Most of researchers got tremendous results for anti–corrosion. The results reveal 95-98% efficiency for anti–corrosion protection. The results show that these anti-corrosion materials have great application potential in commercial industry.

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