PREPARATION AND CHARACTERIZATION OF ANTICORROSIVE AND FLAME RETARDANT $Mg(OH)_2$ - POLYMER COATING STARTING WITH ANILINE AND NATURAL DOLOMITE

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Organic coatings are widely used to protect metallic substrates from aggressive environments which mainly cause in corrosion. Nowadays, most of these organic pigments are synthesized by intrinsically conducting polymers. Polyaniline (PANI) is one of the most extensively studied anticorrosive polymers, due to its excellent properties as an anticorrosive agent. Because of its chemical stability, relatively high conductivity, resistance against corrosion, it has been performed a major role in many researches over the past decades. However, these organic coatings are low resistant to fires and flames and therefore, these coatings can be damaged if the structure is subjected to the flame. This problem can be overcome by incorporating flame retardants to the coating. In this research, polymer pigmented paint coatings have been prepared to use in flame retardation and anticorrosive protection of metal surfaces. One of the commonly used mineral flame retardant is $Mg(OH)_2$ which has an remarkable performance in flame retardation. Due to its high thermal stability with a high melting point, organic coating is also protected by wrinkling and distortion. When even it decomposes at around 330 ^{0}C, it releases water which lowers the contact of combustible gases. Because of its relatively easy preparation, low cost, good inhibition on corrosion, it has given considerable interest in making polymer matrixes with PANI. Therefore, in this study, for the first time, a nanocomposite material is prepared by combining PANI and $Mg(OH)_2$. The PANI/$Mg(OH)_2$ is a novel material and it is synthesized starting from naturally occurring dolomite.

Therefore, the study is also very important on value addition to dolomite. Polymer matrices can be attached to the metal surface through coordination bonds, where PANI chains donate electrons to surface metal atoms. There are several forms of PANI which can conduct, mostly with the conjugation of bonds as a continuous chain. Emeraldine salt is the highest conductive form of PANI while Emeraldine base is less conductive, as Leucoemaraldine and pernigranniline are not. In this research, aniline is polymerized by chemical processes and electrochemical processes at various conditions. Here, before the chemical polymerization suitable oxidant is selected with cyclic voltametry by running a cyclic voltagramme. Potassium persulphate and sodium persulphate are commonly used strong oxidants which can polymerize aniline monomers in acidic medium, in the presence of $MgCl_2$. Formation of $Mg(OH)_2$ is done by the maintenance of pH by adding NaOH drop-wise while stirring.

In this novel preparation method, powdered dolomite (particle size less than 150 μm) is heated at 900 °C for 3 h to produce calcined dolomite (CaO.MgO). The calcined dolomite is added to 1 M sucrose solution to separate CaO component as calcium sucrate solution and to precipitate MgO component of calcined dolomite. The precipitated MgO product is digested in 1 M HCl solution to produce 1 M $MgCl_2$ at pH 5. The $MgCl_2$ (50.0 mL) is mixed with 2.3 mL of aniline. 1 M sodium hydroxide (100.0 mL) and 1 M potassium persulfate (50.0 mL) solutions are added simultaneously and drop-wise to the mixture while stirring. The resulted precipitated product of PANI/$Mg(OH)_2$ composite is collected by centrifuging and is dried well in a vacuum oven at 45 °C and 60 mmHg for 12 h. The composite is mixed with xylene and alkyd resin to produce the coating. These coatings are applied on mild steel surface to study corrosion. Also, coatings are applied on a paper and then burnt under the flame of Bunsen burner to study flame retardation. X-ray diffraction pattern of the composite reveals the presence of brucite crystalline form of $Mg(OH)_2$ in the composite. According to the Debye-Scherrer formula, which is applied to the major peak of XRD of the composite, the crystallite size of brucite is 13 nm. Fourier Transform Infrared (FT-IR) spectroscopic studies confirms the presence of PANI and $Mg(OH)_2$ in the composite. According to tafel plots obtained for coatings on mild steels, corrosion rate of mild steel has been decreased by 275 times by applying PANI/$Mg(OH)_2$ composite coating. Therefore, the PANI/$Mg(OH)_2$ nanocomposite is useful as a surface coating with properties of flame retardation and anticorrosion.