

Method for Identification of Through Defects of Polymer Films Applied onto Metal Parts

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Abstract : Nowadays, many devices operate under conditions of enhanced humidity, temperature drops, fog, and vibration. To ensure long-term and uninterruptable equipment operation under adverse conditions, one applies moisture-proof films on products and electronics components, which helps to prevent corrosion, short circuit, allowing a significant increase in device lifecycle. The reliability of such moisture-proof films is mainly determined by their coating uniformity without gaps and cracks. Unprotected product edges, as well as pores in films, can cause device failure during operation. The work objective was to develop an effective, affordable, and profit-proved method for determining the presence of through defects of protective polymer films on the surface of parts made of iron and its alloys. As a diagnostic reagent, one proposed water solution of potassium ferricyanide (III) in hydrochloric acid, this changes the color from yellow to blue according to the reactions; $\text{Fe}^0 \rightarrow \text{Fe}^{2+}$ and $4\text{Fe}^{2+} + 3[\text{Fe}^{3+}(\text{CN})_6]^{3-} \rightarrow \text{Fe}^{3+} + 4[\text{Fe}^{2+}(\text{CN})_6]_3$. There was developed the principle scheme of technological process for determining the presence of polymer films through defects on the surface of parts made of iron and its alloys. There were studied solutions with different diagnostic reagent compositions in water: from 0,1 to 25 mass fractions, %, of potassium ferricyanide (III), and from 5 to 25 mass fractions, %, of hydrochloride acid. The optimal component ratio was chosen. The developed method consists in submerging a part covered with a film into a vessel with a diagnostic reagent. In the polymer film through defect zone, the part material (ferrum) interacts with potassium ferricyanide (III), the color changes to blue. Pilot samples were tested by the developed method for the presence of through defects in the moisture-proof coating. It was revealed that all the studied parts had through defects of the polymer film coating. Thus, the claimed method efficiently reveals polymer film coating through defects on parts made of iron or its alloys, being affordable and profit-proved.

Keywords : diagnostic reagent, metal parts, polymer films, through defects

Conference Title : ICCCECP 2021 : International Conference on Chemistry, Chemical Engineering and Chemical Processes

Conference Location : Istanbul, Türkiye

Conference Dates : November 08-09, 2021