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POWDER COATINGS BY FLUIDISED BED TECHNIQUE

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ABSTRACT

The powder coating technique has advanced in recent years with new types of polymers including thermosetting and thermoplastic types of resins. In the present study epoxy polyester and polyester powder were used. The panels coated with different thickness of coatings and various physical and corrosion resistance properties of the coatings were evaluated.

Key words: Powder coatings, fluidised bed technique, polyester based coatings

INTRODUCTION

Powder coatings are now accepted in modern surface technology for mass production and the coatings of varied substrates. Powder coatings are being used for bus/lorry chassis, metal window frames, bicycles, pipes, motor components, light fittings, etc. The major advantages of powder coatings are [1-3]:

a) one coat system
b) the recycling of oversprayed powders
c) reduced fire hazards due to absence of solvents and
d) reduced pollution of the atmosphere.

The disadvantages are:

a) powder must be retained in dry pulverised form
b) thin coating (say 25-50 μm) are not always possible and
c) temperature for curing required may degrade soft solder joints of some substrates.

Though the initial cost of setting up powder coating unit is high it can invariably be recovered within 3-4 years by the considerable savings in other areas such as [4]:

a) elimination of primer coats
b) reduction in labour costs by as much as 50%
c) no need for thinning or mixing before application of the powders supplied and
d) economy in paint shop heating costs and in cost of paint storage.

Storage with various powdered resin systems have been reported [5]. In this paper properties of epoxy polyester and polyester coatings obtained by fluidised bed technique at dealt with.

EXPERIMENTAL

Mild steel plates of three different sizes 5 x 7.5 cms, 10.0 x 10.0 cms and 20.0 x 10.0 cms were degreased with trichloroethylene and cleaned in acid.

The experiments were carried out with a laboratory scale set up of fluidised bed of 17.8 cms diameter and 61 cms height. The material of construction was polyvinyl chloride and perspex. The perspex was used as glass window to see the extent of fluidisation. The cleaned air was passed from the compressor at the rate of 2-4 M^3/hr.

The cleaned specimens were heated to 200°C in an oven and then dipped in the fluidised bed where the powders were already in the fluidised state. After deposition of powders to the required thickness, the specimens were taken out from the bed and kept in the oven for 10-15 min. at a temperature of 180°C for complete curing. The thickness of coating was varied by altering the dipping time in the fluidised bed. For the studies, polyester and epoxypolyester powders were taken. The various physical and corrosion resistance properties of the coatings were evaluated. The thickness of the coating was measured with the help of Elcometer.

Physical tests

Scratch hardness test
This test was carried out as per IS Specification 101 using AIM 601 Scratch hardness tester. A maximum load of 3 kg was used.

Gloss measurement
Gloss was assessed with the gloss meter as per ASTM 523. Smooth white surface was taken for epoxy-polyester and polyester coated panels

Conical Mandrel test
The test specimen was kept upright on its lengthwise position between the mandrel and draw bar. It was then tightly clamped in position in such a way that end of the coated specimens adjacent to the narrow end part of the conical mandrel is almost touching the side of the draw bar lever frame. The lever was moved through about 180 degrees at uniform velocity to bend the specimen approximately in about 15 seconds. The lead surface of the specimen was examined immediately with naked eye for any cracking. After marking the end of the crack, the draw bar was brought to the starting position. The panel was removed from the mandrel and examined microscopically for the cracks under 60 x or 100 x magnification.

Abrasion test
In this test the coated specimen was mounted on a turn table that rotates at 60 rpm under a pair of weighted abrading wheels of close controlled composition, in such manner as to cause side slip between the abrading wheels and surface of the test specimen.

Porosity test
This test was conducted using DC Holiday Detector Model 105. Porosity was examined by applying voltages. If no pores were detected at the prescribed voltage, the voltage was increased upto the breakdown of the film and this breakdown voltage was compared for each coating.

Corrosion resistance tests
i) Immersion in sodium chloride
The powder coated samples were kept immersed in 3% sodium chloride

solution for a period of 30 days. The deposit was examined periodically and the observations were recorded. After 30 days, the film was removed and the substrate surface was examined.

ii) Salt spray test

This was carried out with 3% sodium chloride solution in the unit supplied by Canning. Specimens were subjected to the test for 500 hrs. and were examined for blisters and other defects. At the end of the test, the coating was removed by solvent and the metal surface was examined.

RESULTS AND DISCUSSION

By adopting fluidized bed technique satisfactory coatings could be obtained from both polyester and epoxy polyester powders. It was found that the coatings with thicknesses 100-250 μm were uniform and smooth. Coatings above 250 μm thickness developed roughness. However, the adhesion of the coatings was quite good and even beyond this thickness; so there is scope for improving the quality at higher thicknesses of the coating by varying parameters.

From the results of the evaluation test (Table I) it is quite evident that the performance of both types of powders is the same except in breakdown test and abrasion test.

Table I: Physical and corrosion resistance of the coatings

Physical and Corrosion resistance tests	Epoxy polyester powder coated	Polyester powder coated
1. Scratch hardness 3 kg	passes	passes
2. Gloss	90-95%	90-95%
3. Feasibility test	pass 3 mm	pass 3 mm
4. Abrasion test	30-40 mgms/ 1 kg load/ 1000 revolution	45-60 mgm/ 1 kg load/ 1000 revolution
5. Breakdown voltage		
(100 μm thick)	10 KV passes	5 KV passes
(150 μm thickness)	15 KV passes	6 KV passes
6. Immersion in 3% sodium chloride solution for 30 days	Not affected	Not affected
7. Salt spray test (500 hrs.)	Not affected	Not affected

These two tests show that the epoxy polyester has got a slight edge over the other system and will be useful where such properties are specifically needed. So, where these two properties are not of much significance, one can go in for either of the two, naturally the less costly one.

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