

DESIGNING OF A SINGLE PACK WASH PRIMER FOR ALUMINIUM SURFACES IN A MARINE ENVIRONMENT

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Design aspects and comparative performances of different laboratory formulations of wash primers were studied under laboratory and field conditions with reference to scratch hardness, flexibility, stability, resistance to corrosion and adhesiveness. The different formulations of single pack wash primers tested have shown superiority of the formulation prepared out of "mowital" and that it is comparable in performance to double pack wash primer.

INTRODUCTION

Painting of a metallic surface both ferrous as well as non-ferrous, poses a serious problem, particularly when such surfaces are exposed to marine environment. The problem will be all the more critical when marine quality aluminium magnesium alloy sheets come into regular use where the smooth and glossy surface of aluminium will present problems in regard to application of paint. The aluminium surface will have to be chemically etched with a suitable etchant or "wash primer" so that the surface is evenly prepared and chemically roughened for the proper holding of the subsequent paint coatings as described by Balasubramanyan *et al* (1968). Till recently the commercial wash primers were marketed in the conventional dual pack system containing a pigmented

resin part and the acid part. Boat builders and aluminium fabricators have been experiencing difficulties in handling the dual pack primer involving extractions, labour and the need for strict vigilance in mixing and application. To overcome this difficulty, a ready mixed single pack wash primer incorporating cheaper substitutes was thought of. A new chemical etchant for aluminium surfaces was formulated and its basic characteristics studied and the results are presented in this paper.

MATERIALS AND METHODS

A known commercial dual pack wash primer was used as a control. Analysis have shown that the pigmented base contained 3-10% of polyvinyl butyral resin and 8-10% zinc tetroxychromate by weight

besides inert pigments and alcohol. The phosphoric acid content of the acid part was about 15-20% by weight.

In the present investigation, the resin part was substituted by materials, which are easily available, like cashewnut shell liquid, *Silix**, Phenolic resin, Mowital**. Zinc tetroxychromate was substituted by barium potassium chromate as suggested by Singh *et al* (1968). Different percentage combinations of resin and acid was tried and after initial screening, three different successful formulations (Table I) were selected for further comparative studies.

Primers, thus prepared were brushed uniformly on clean, degreased, aluminium-magnesium alloy test panels. The surface film was allowed to air dry and harden for 3 days before tests for scratch hardness and flexibility were made and recorded. The results obtained are presented in Table II

After 24 hrs., a single brush coat of zinc chromate paint was given to all the aluminium test panels that have already been primed. After aging for 10 days under normal laboratory conditions, a scratch test was made to determine the extent to

TABLE I

Formulation No.	% of phosphoric acid (85% H_3PO_4) by weight.	% of barium potassium chromate by weight.	Type of resin used	% of resin used by weight.
1	10.0	17.0	Phenolic	12.0
2	10.0	17.0	Silix	14.0
3	10.0	17.0	Mowital	12.0

which the chemical surface treatment prevents the spread of corrosion from these unprotected areas between the base metal and the coated areas. The scratch of a width of about 1 mm (0.04 inch) was made so as to penetrate down to the base metal on each side. The test panels were exposed to conditions of accelerated corrosion in a standard salt spray cabinet. A continuous uniform spray of fog was maintained in the cabinet throughout the period of exposure. The treated panels were also subjected to atmospheric exposure and immersion test in sea water at the C. I. F. T. test site. The results are presented in Table III.

Stability of the paint coating under the adverse working conditions is an important pre-requisite for any new composition. In order to study the stability pattern of the new paint formulation, laboratory compositions were applied on standard degreased aluminium magnesium panels followed by zinc-chromate paint. After a thorough surface drying a standard X-cut was made on one side on each of the test panel. The panels which were cathodically protected at -1.2 volts relative to silver/silver chloride electrode were immersed in a tank with constant overflow of sea water. A potential of -1.2 volts equal to what generally exists near ships' bottom was chosen.

* Product of M/s. Phenolic Resin (Pvt.) Ltd., Quilon.

** Synthetic resin product of M/s. Hoechst Dyes & Chemicals Ltd., Bombay.

TABLE II

Formulation No.	Scratch hardness in grams according to IS : 101 (1964)		Flexibility No. 9 Mandrel, dia. 0.28 cm according to IS: 101 (1964)
	Fresh formulation	After 90 days shelf life	
1	1300	900	Film slightly cracked
2	1200	800	Film does not crack or peel
3	2000	1600	Film does not crack or peel
Commercial dual pack sample (Control)	2300	No shelf life	Film does not crack or peel

DISCUSSION

The performance of formulation No. 3 with respect to its general characteristics were found to be highly promising according to the tests conducted as per IS:101 (1964). The shelf life, after six months, was found satisfactory for this sample. Salt spray tests were carried out mainly with the object of evaluating the behaviour of wash primer under the expected conditions of marine atmosphere. Sample (1943) suggested that the correlation between the result of the test and the actual performance in the field gives the quality of wash primer. The film of the formula-

tion No. 1 and 2 were found to be damaged. No visible damage was seen for the film of formulation No. 3 and its performance was comparable to dual pack wash primer. The performances of all the formulations were satisfactory with respect to atmospheric exposure and immersion test. Arthur Anderton (1964) had established the general relation between stability of the paint and cathodic protection. From the tests, it was seen that the loss of adhesion occurred only near the cut, proving the existence of less negative potentials in those areas. The adhesion of laboratory formulation No. 3 was highly

TABLE III

Formulation No.	Accelerated salt spray test 96 hours	Atmospheric exposure test 9 months	Field test (immersion) 9 months
1	Some damage to film—easily scratched	No visible damage	No visible damage
2	Some damage to film—light under rusting.	-do-	-do-
3	No visible damage	-do-	-do-
Commercial dual pack sample (Control)	-do-	-do-	-do-

satisfactory in this test and there was no sign of corrosion. It was found after 21 months of service, that laboratory formulation No. 3 gave a protracted life to all the paint coatings and the basic metal has been sound and safe, thus proving the successful performance of the new formulation. It also gave an overall satisfactory performance as a suitable single pack wash primer; primarily suitable for coating on the aluminium magnesium alloy sheathing on wooden hulls of fishing boats.

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