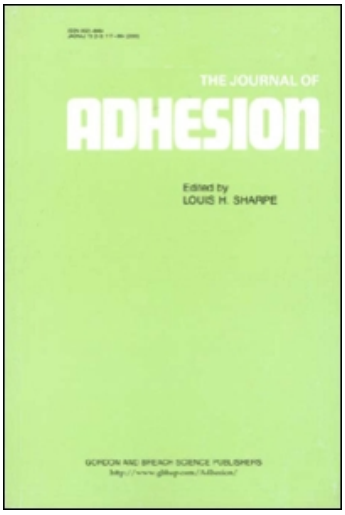

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Note

Paste Forms of a Cold Chromate Etch Treatment for Aluminium

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INTRODUCTION

While the usual etching treatments in baths of solution are convenient and satisfactory for comparatively small components in conditions of factory manufacture, they are less adequate for large components and conditions which are less well controlled. To meet these conditions various modifications to produce etching treatments in a paste form have been explored. Many of these have involved the phosphoric acid anodising process but there have been reports of a paste formulation of the FPL chromic acid treatment although the details have not always been very precise.

As an adjunct to the study of a room temperature modification of the conventional FPL chromic acid treatment for aluminium alloys,[1] some exploration was undertaken of a paste modification of this.

EXPERIMENTAL WORK and RESULTS

All the work was done with the weldable aluminium alloy DG FVE 232 and Redux 410 (Ciba-Geigy) modified by the addition of balotini to control glue line thickness.

The treatment used was the modified cold etch process described in a fuller publication.[1] This essentially involves treatment at room temperature in 8% w/v sodium carbonate solution for 1 hour and subsequent treatment in an etching solution (27% w/v H_2SO_4 and

7.5% $Na_2Cr_2O_7.2H_2O$) for 4 hours, with rinsing and drying sequences.

Initially two different thickening agents were used: silica (Manosil VN3) and aluminium silicate (Silteg AS7). These were used with both the sodium carbonate and the chromic acid solutions; adding sufficient to produce a thick creamy paste which would remain in place. This amounted to 30% w/w in each case, except that of aluminium silicate with chromic acid which required 40% w/w. The treatment of specimens followed the standard cold etching procedure except that instead of immersion in either sodium carbonate or chromic acid solution a layer of paste about 1 mm thick was spread on the metal surface with a spatula and was left in place for the requisite time. The four possible combinations used were: (1) silica/silica; (2) aluminium silicate/aluminium silicate; (3) silica/aluminium silicate; (4) aluminium silicate/silica; in sodium carbonate and chromic acid solutions respectively.

Joints were made and tested in the usual way with the Boeing Wedge Test in water at 40°C.

The results are shown in Table 1 with the results for similar conditions with solutions from reference 1 for comparison.

TABLE I
Effect of various combinations of thickening agent on durability of joints

Paste	Total crack length (mm) after immersion for: 0 hr	1 hr	3 hr	24 hr	increase in 24 hr %
1	37.2	46.7	52.2	58.5	57
2	35.5	47.7	52.4	59.1	67
3	36.5	46.8	51.7	51.7	55
4	39.2	48.6	53.7	62.7	60
Solution	35.2	46.9	50.9	59.6	69

The crack lengths quoted are means for 6 measurements and these means each showed a standard error of about 0.6 mm.

No very obvious or significant difference emerged although the results suggest that paste treatments, particularly those using silica in the sodium carbonate solution, gave slightly more durable joints.

A further series was tried using sodium carbonate in solution (as in the standard F.P.L. procedure) but with the chromic acid thickened with silica, and varying the period for which the chromic acid etching was continued. The results of this series are shown in Table II.

TABLE II
Effect of period of etching with thickened chromic acid

Etch time hours	Total crack length (mm) after treatment for: 0 hr	1 hr	3 hr	24 hr	increase in 24 hr %
1	41.4	51.1	51.9	56.6	37
2	40.8	50.3	51.1	54.9	35
3	42.4	50.4	53.4	55.7	36

Here it is very clear that there is no difference between these joints either in initial strength or in durability, although it might be suggested that they were initially slightly weaker than any of the earlier series but less affected by immersion in water.

It is clear that reasonably satisfactory results can be achieved with chromic acid thickened to a paste consistency with silica or aluminium silicate. This modification of the usual etching process for the preparation of surfaces for adhesive bonding could be very useful and effect considerable economies in dealing with large components or with situations where very careful control of conditions is difficult.

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Reference

1. K. W. Allen and M. Smith, J. Adhesion.