



Technologies

TECHNICAL BULLETIN

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NO. 443

1. INTRODUCTION

No. 443 is a unique blend of chemicals to be added to a sodium hydroxide solution to produce an etch for aluminium that allows continued operation without the need for dumping.

No. 443 has the following advantages over conventional etchant systems:

- Greatly extended bath life.
- Reduced down-time.
- Increased plant utilisation.
- Consistent etch quality.
- Simple control methods.
- No heavy scale deposits.
- Wide range of operating temperatures.
- Less metal removal to achieve good finish.
- No sludge formation if solution is cooled.
- Overall cost efficiency.

2. PLANT AND EQUIPMENT

Mild steel may be used for the construction of plant and equipment. An efficient fume extraction system should be provided.

3. PREPARATION OF "CAUSTIC ETCH CONCENTRATE"

No. 443 is mixed with liquid caustic soda in the bulk storage tank to give a "caustic etch concentrate".

By volume 1 litre **No. 443** to every 6.3 litres 46% w/w liquid NaOH.

By weight 1 kg **No. 443** to every 7.9 kg of 46% w/w/ liquid NaOH.

Adequate recirculation or stirring is necessary to ensure that **No. 443** is mixed uniformly with the bulk liquid caustic soda.

3. PREPARATION OF “CAUSTIC ETCH CONCENTRATE” cont.

During operation of a long life etch solution, the sodium aluminate concentration will increase up to approximately 400 grams per litre, (this is equivalent to approximately 130 g/L aluminium), when an equilibrium point is reached. At the equilibrium point, sodium aluminate will be carried out of the bath as ‘drag-out’ at the same rate as it is formed by dissolved aluminium. At this stage adequate post-etch rinsing is essential.

As the aluminate content increases towards the equilibrium condition, it is necessary to increase the free causticity of the etch solution to maintain the etch rate and the bath stability. Full information on operating procedures for **No. 443** are given below.

4. OPERATING INSTRUCTIONS FOR ETCHANT BATHS

The successful running of a long life etch solution will vary from operation to operation depending on workload, size of tank, type of alloy, conditions of extrusions and etch finish required. Our representatives will be pleased to advise on optimum conditions for specific operations.

In most operations the initial charge will be 5% v/v of caustic etch concentrate.

It is usual for an etch bath to be operated at 60 – 65°C; etch times will vary from 4 to 15 minutes, depending on surface etch required.

It should be noted that the initial etch rate (metal removal rate) will be lower than for the equivalent concentration of a conventional caustic etchant. In most cases, however, the finish will be equivalent, or superior and etch rate may be disregarded.

5. MAINTENANCE OF ETCH SOLUTION

As the sodium aluminate level builds up, the caustic etch concentrate concentration should be increased as shown in the following table.

Sodium Aluminate g/l	% C.EC
0 - 100	5% v/v
100 – 400	12% v/v

As the equilibrium point is reached, the rate of increase in sodium aluminate content will fall-off, until it reached a maximum for the particular operation. This will usually be from 300 – 400 grams per litre, and the time taken from 4 to 12 weeks. Following equilibration, the caustic etch concentrate is held at the appropriate concentration to maintain the required etch finish and bath stability.

6. CONTROL AND MAINTENANCE OF TANK

Control of an etch solution is based on determination of the concentrations of etchant and sodium aluminate, using a pair of acidimetric titrations.

7. ANALYSIS

To a 10 ml sample of the etch solution, add 100 ml distilled water, 15 ml of 20% sodium gluconate solution and 5 ml of 10% barium chloride solution. Add a few drops of phenolphthalein indicator and titrate with 1.0N sulphuric acid to a colourless end point. Number of mls acid = **Titration A**.

When this end point is reached, add 10 ml of Reagent Solution 37 (pink colour returns) and titrate again with 1.0N sulphuric acid to a colourless end point. Add further 10 ml portions of potassium fluoride and titrate again until no pink colour re-appears. The total mls of 1.0N sulphuric acid used after the first addition of potassium fluoride is **Titration B**.

$$\text{Concentration of Caustic Etch Concentrate} = 0.58 (A-B/3)\% \text{ v/v}$$

$$\text{Concentration of Sodium Aluminate} = 2.72 \times B \text{ grams per litre}$$

As the sodium aluminate content increases, the sample volume should be reduced so that for over 200 grams per litre of aluminate, a 2 ml sample is used. The volume of sodium gluconate, barium chloride and Reagent Solution 37 should remain the same.

Recommended sample sizes are:

0 – 100 grams per litre Sodium aluminate	-	take 10 ml sample.
100 – 200 grams per litre Sodium aluminate	-	take 5 ml sample and multiply titration figures by 2.
200 – 500 grams per litre Sodium aluminate	-	take 2 ml sample and multiply titration figures by 5.

8. EFFLUENT

Post – etch rinse waters may contain sulphide ions and generally a higher content of solids than when conventional caustic etches are used. Aeration of rinse tanks will minimise the sulphide content. Also, by running the post – etch and post desmut rinses together to effluent, residues of desmut solution will often oxidise the sulphide and render the effluent acceptable.

The presence of sulphide ions in effluent may be established by the addition of sodium nitroprusside, which will give a purple colouration.

If sulphide is shown to be present in the effluent; it may be removed by addition of sodium hypochlorite solution. The amount may be determined by laboratory testing of a representative sample and sodium nitroprusside can be used to indicate its complete removal.

9. DISPOSAL

Should it be necessary in an emergency to dump an etch tank immediately, it should be treated with sodium hypochlorite or other recommended oxidising agent. As the alkalinity will also be required to be at least partially neutralised, considerable dilution will be required – therefore it is recommended that all rinse tanks and seal tanks be dumped at the same time as etch bath.

DISCLAIMER

Any information given is, to the best of our knowledge, the best currently available, with respect to our products and their use, but it is subject to revision as additional knowledge and experience is gained. Such information is offered as a guideline for experimentation only and is not to be construed as a representation that the material is suitable for any particular purpose or use. Customers are encouraged to make their own enquiries as to the material's characteristics and, where appropriate, to conduct their own tests in the specific context of the material's intended use. This information is not a license to operate under nor is it intended to suggest infringement of any patent. We guarantee a uniform quality standard for this product. The only conditions and warranties accepted by Henkel in relation to this product or process are those implied by either Commonwealth or State statutes.