NASA TECH BRIEF

Mixed Ether Bath for Electrodeposition of Aluminum

A description is given of an improvement in the Brenner aluminum plating bath technique based on the addition of anisole to the bath mixture. This improved mixture has a lower bath vapor pressure and the electro-deposits obtained from this mixture have greater physical strength than deposits from the Brenner bath. The mixed ether bath consists of:

Anisole to ethyl ether (volume ratio) 1:2

Aluminum Chloride (Molar concentration) 3.4M

Lithium aluminum hydride (Molar concentration) 0.3–0.4 M

However, the operation of the aluminum plating bath is very hazardous because of the ether content and the bath reaction with oxygen, carbon dioxide, and moisture. Consequently, the operations of the plating bath are conducted in a dry nitrogen atmosphere within a glove box.

The mixed ether is cooled during the addition of anhydrous aluminum chloride ($AlCl_3$) by an immersed cooling coil through which a coolant is circulated.

The $AlCl_3$ is slowly dissolved into the cold mixed ether carefully so that the bath temperature does not exceed 303°K. If $AlCl_3$ is added too rapidly, severe localized heating occurs which darkens the solution and occasionally produces unsatisfactory deposits. After the solution is prepared, it remains undisturbed for 16 to 24 hours to permit settling of the minute grey suspended particles. A medium-porosity fritted-glass Buchner filter is then used to produce the desired crystal clear, light amber solution.

The complete plating solution is accomplished by slowly mixing the $AlCl_3$-mixed ether solution with the lithium aluminum hydride ($LiAlH_4$)- mixed ether solution. This addition of $LiAlH_4$ must be carefully performed to prevent excessive foaming, temperature (kept below 303°K), and localized precipitation. The bath is complete when the molar concentration of $LiAlH_4$ is between 0.3 and 0.4 M in the resultant solution and the molar concentration of $AlCl_3$ is 3.4 M.

The mixed ether bath for the electrodeposition of aluminum may be used to produce various lightweight structures, pressure vessels, or cryogenic tank liners.

Note:

Requests for further information may be directed to:

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Reference: TSP69-10737

Patent status:

No patent action is contemplated by NASA.

Source: Kenneth Lui of
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under contract to
Langley Research Center
(LAR-10200)

Category 03