

Effect of Mass Flow Induced By a Reciprocating Paddle on Electroplating

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Abstract

The reciprocating paddle electrochemical plating cells have been widely applied in microelectronics industry [1-2]. The reciprocating paddle is often driven over a cathode aspect horizontally by oscillation set outside a plating cell. The paddle reciprocating parallel to a plating side stirs the electrolyte around the plating aspect to improve electric current distribution on the cathode. The uniformity of plated film will be improved. However, theoretical analysis is considerably complicated because the flow induced by the reciprocating movement of the paddle, mass transport and current density distribution have to be fully coupled.

In this work, the mass flow induced by a reciprocating paddle in the electroplating cell is studied by the finite element analysis software-COMSOL Multiphysics. The reciprocating movement of the paddle is simulated by moving mesh technique (Arbitrary Lagrangian Eulerian: ALE method) and the solution of fluid flows stirred by the paddle is coupled into the calculation of tertiary current distributions. The reciprocating frequencies are 0.5, 1, and 2 Hz. An acid copper sulfate electrolyte composed of 50 mM Cu₂SO₄ and 0.5 M Na₂SO₄ is taken into account. The results shows that the reciprocating movement of the paddle could effectively improve the concentration distribution of cupric ions and the current density distribution on the cathode.

Keywords : Electroplating, Reciprocating Paddle, Moving Mesh, Mass Transfer, Current Distribution

Reference

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