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Design and Analysis of Direct Side Inflows in Copper Electrolytic Cells by a Computational Method

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Abstract

A new copper electrolytic cell with two different inlet/outlet configurations was designed and modelled to study the effects of direct side inflows on electroplating and fluid flow field. Unlike electrolyte inflows in conventional electrolytic cells that have an inlet and an outlet far from electrodes, direct side inflows go directly to the inter-electrode gap from inlets on the side walls and have direct impact on the fluid flow field between electrodes. Copper electrorefining was simulated in the new electrolytic cell for both inlet/outlet configurations. The results show that direct side inflows can lead to more uniform species distribution and more efficient mass transfer, which can allow electroplating at higher current densities and lower electrolyte copper concentrations. Also, direct side inflows intensify electrolyte flows and convection in the inter-electrode gap, which is the underlying reason for the improved mass transfer in the new electrolytic cell. The upper-inlet/lower-outlet configuration has advantages over the lower-inlet/upper-outlet configuration in electrolyte flow field and mass transfer, as well as slime particle movement and collection.

Keywords Direct side inflows; New electrolytic cell; Inter-electrode gap; Mass transfer; Lower-inlet/upper-outlet configuration; Upper-inlet/lower-outlet configuration.