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The Role of Lead in Suppressing Passivation of High Silver-Containing Copper Anodes During Electrorefining

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Passivation behavior of high silver containing copper anodes was investigated using slowly cooled Cu-1%Ag anodes of different lead (Pb) concentrations. The addition of Pb distributes silver in the Pb phase and reduces the amount of silver that is solidly soluble in copper and, thus, generates a fine silver powder on the anode surface which is a main contributing factor of passivation. Electrorefining experiments were conducted using a synthetic electrolyte containing 40 g/L Cu^{2+} and 180 g/L H_2SO_4, at 60° C. SEM-EDS analysis was used to study the resulting anode slime and showed that increasing Pb content altered the anode slime structure from fine and compact to porous and less adherent to the anode surface. Utilizing a Cu-1%Ag-0.2%Pb anode yielded the longest passivation time with a low and stable cell voltage of 0.1V. The slime morphology was characterized by precipitated metallic silver particles either as inclusion or loosely present on the surface of the abundant complex Cu-Ag-Pb sulfate type of compounds. Because of the economic importance of silver recovery from the anode slime, understanding its behavior during electrorefining will enable operating with high impurity anodes especially in secondary copper processing where metallic impurities can result from e-waste and copper alloy scrap.

Keywords : Electrorefining, passivation, silver-containing copper anode, anode slime