

Fig. 1. lnk vs. temperature

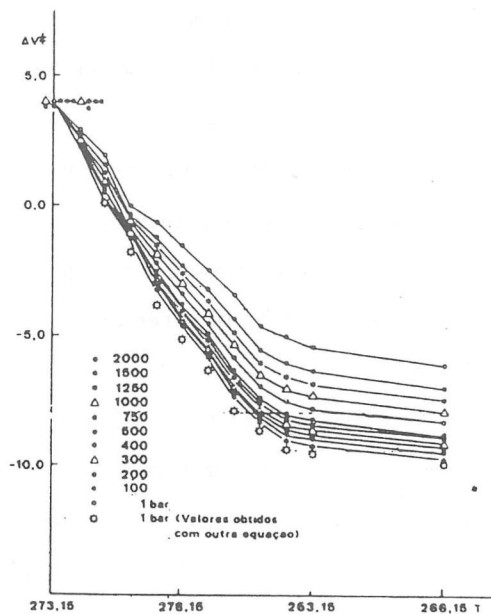


Fig. 2. ΔV vs T

CEMENTATION OF COPPER ON PACKED BEDS OF ALUMINIUM PELLETS

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Introduction

Cementation, or contact reduction, processes have long been used as electrochemical methods of recovering metal ions from aqueous solutions by spontaneous precipitation on a less noble metal. Recently, the use of aluminium from waste drink cans as a cementing agent for the deposition of copper has been reported [1]. However, as with many other cementation systems, little effective engineering data exists for the design and scale-up of such processes. It was decided to investigate the performance of a bed of aluminium pellets as a substrate for Cu deposition with a view to obtaining mass transfer data for the system. The overall reaction is



Experimental

The experimental approach was to recirculate a batch of CuCl₂-containing electrolyte through a system incorporating a packed bed cementation reactor and a well-stirred 25l reservoir (Figure 1). This is a similar system to that used by Walker and Wragg [2] in fluidised bed copper recovery studies and by Bravo and Wragg [3,4] in recent cementation studies using the Cu-Fe system. Batches of the CuCl₂ solution, acidified to different initial pH values using HCl, were continuously recycled and small samples were taken from the reservoir for analysis of the copper and aluminium content at different times. The initial Cu⁺⁺ content was ≈ 600 ppm.

The packed bed consisted of a 39 mm i.d. glass column filled with Al pellets, of equivalent diameter 7.24 mm, to a height of approximately 100 mm. Samples of the powdery Cu deposit were collected for observation of its morphology using scanning electron microscopy.

Results

A typical concentration-time history for a batch recirculation experiment for different initial pH values is shown as Figure 2. It can be seen that the rate of depletion of Cu is approximately linear and that it is notably faster for more acidic solutions. From such concentration-time plots, mass transfer coefficients, K , could be evaluated and showed a distinct tendency to increase with time as indicated in Figure 3. This time dependence of the K values was attributed to the extremely dendritic morphology of the copper deposit, as evidenced by the scanning electron microscopy, with a consequent massive increase in the effective surface

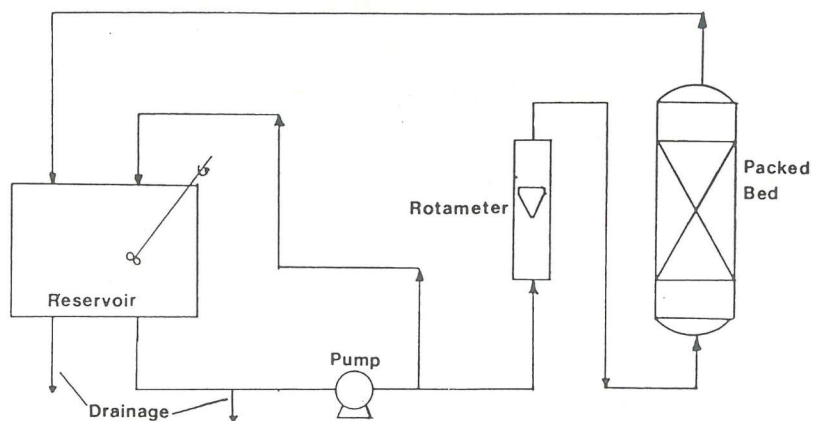


Fig.1. Apparatus For Batch Recycle System

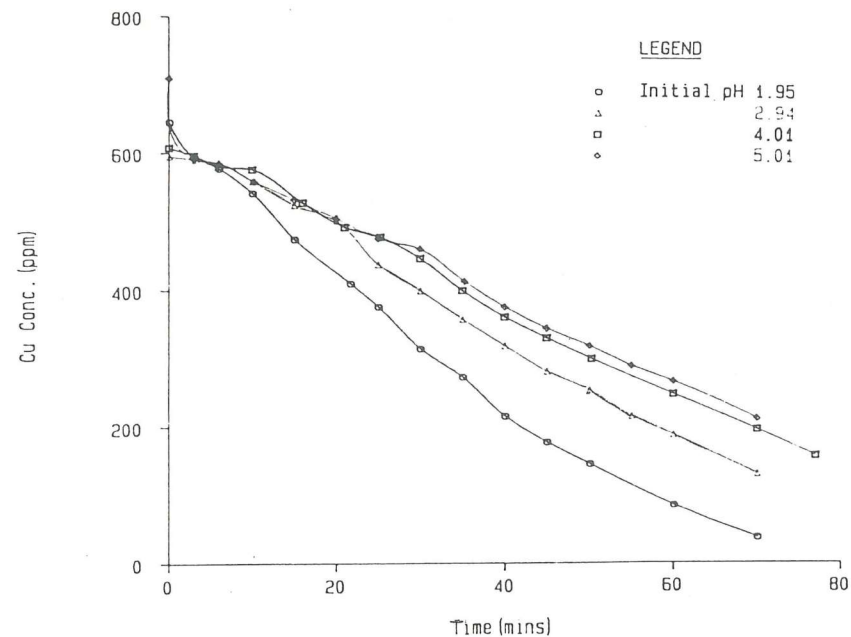


Fig 2 Copper concentration against time

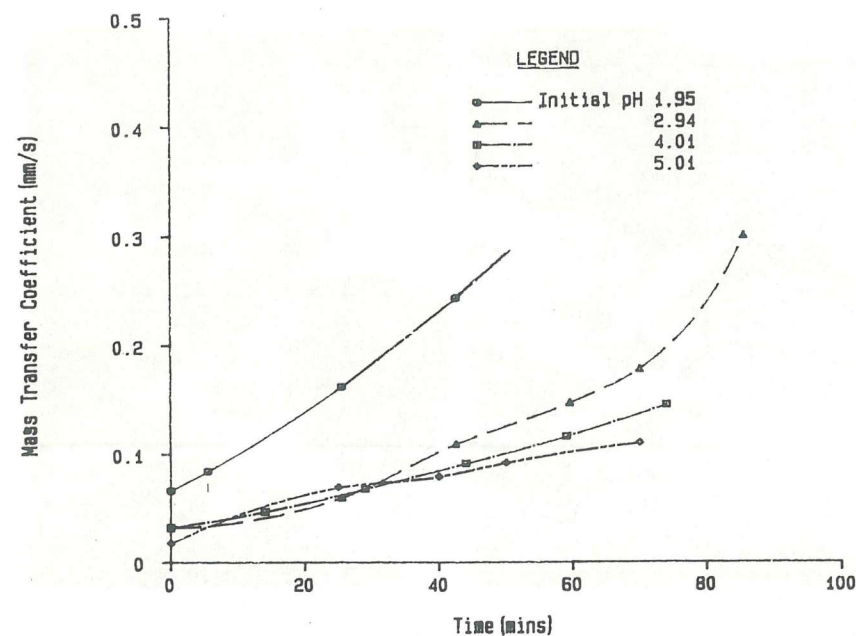


Fig 3 Mass transfer coefficient against time

area. Figure 4 shows typical SEM's of copper deposits for two values of pH. A further cause of mass transfer enhancement at low pH may be the co-evolution of hydrogen bubbles.

Values of the mass transfer coefficient were compared with data from other sources for solid-liquid mass transfer processes and were, in general, far higher.

References

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3. Bravo de Nahui, F.N. and Wragg, A.A. *Extended Abstracts, 36th ISE Meeting, Salamanca, Spain (1985)*.
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Fig 4 SEM's of copper deposits at pH 2.9 and 6.0

THE Pd-GATE MISFET AS AN ELECTROCHEMICAL SENSOR FOR CORROSION PROCESSES

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ABSTRACT

The development of sensitive devices has always played a major role in the progress of electrochemistry itself. One of the most significant achievements in the field of solid state sensors has been the emergence of the chemically sensitive field effect transistor (CHEMFET). Several CHEMFET sensors for use in both solution and gas phases have been researched for the last few years, and those devices generally fall into one of the following categories: ion sensitive field effect transistors (ISFETs), introduced in 1970 by Bergveld [1], and gas sensitive field effect transistors (GASFETs), first reported by Lundström et al. [2]. They can be made to respond to chemical stimuli from charged or neutral species, whose changes influence the threshold voltage and, therefore, are translated into the drain current of the FET [3].

ISFETs and GASFETs have great possibilities of practical utilization in industry, agriculture, medicine, and, broadly speaking, in every branch of science and technology where selective monitoring of substances down to trace amounts is a major concern [4-6]. The application of solid state chemical sensors to corrosion processes has been proposed recently [7], although the idea could be sought to run through the former spectral analysis of ISFET's drain current