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.

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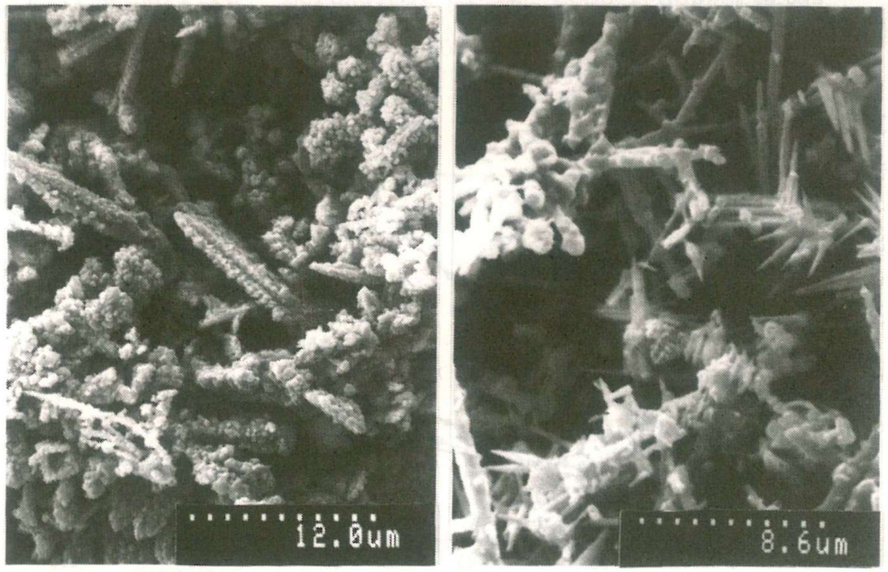

Fig 4 SEM's of copper deposits at pH 2.9 and 6.0

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

C.A.C. Sequeira*, A.M.G. Pacheco*, M.G.I.B. Teixeira**

*Laboratório de Electroquímica, Instituto Superior Técnico
Av. Rovisco Pais, 1096 Lisboa Codex, Portugal

**Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa
2825 Monte da Caparica, Portugal

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

noise [8]. Many corrosion situations deal with extremely small amounts of the aggressive agent, and, therefore, it can be anticipated that the above-mentioned application would be particularly advantageous.
This paper presents a modified ISFET for continuous hydrogen monitoring, in which the ion-selective membrane has been replaced by a palladium gate. The sensor is designed to give a fast response not only to changes in hydrogen content, which may cause embrittlement phenomena, but also to hydrogen evolved at the metal-electrolyte interface, thus being suitable for the assessment of effects from low pH condensates and/or acid rain attack.
Acid rain is a major subject of concern on ecological grounds, and the slope of bilogarithmic laws for atmospheric corrosion of zinc, carbon steel and copper has been expressed as a function of the average rain pH in a recent attempt at reconciliation of corrosion data on a worldwide basis [9]. In these terms, practical experience with the Pd-gate MISFET is liable to provide an accurate on-line monitoring of atmospheric damages, inasmuch as electrochemical data from bulky ACMs underestimate the true corrosion rates to an appreciable extent [10] and cell factors often show an erratic site-to-site behaviour [11].

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