

## Photoluminescence: *in situ* probe to follow the quality of Cu electrodeposition

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Electrochemical deposition of metals, especially copper deposition plays an important role in many modern technologies. Several studies have described the deposition on silicon [1] but few works have been reported on the deposition of metals on III-V semiconductors.

In a recent paper [2], the underpotential deposition of copper on GaAs was investigated in an aqueous sulphuric acid. The photoluminescence has been evidenced to be a powerful *in situ* tool to detect a 0.5 equivalent monolayer of copper on p-GaAs and an independent deposition kinetics on the potential value in the potential range of copper reduction.

In this contribution, we present results obtained on the underpotential deposition of copper onto n-InP. This investigation emphasises on the *in situ* study of the deposition kinetics by coupling photoluminescence and electrochemical measurements (Fig.1). The photoluminescence decrease and the recovery of the initial photoluminescence are used to investigate the copper surface coverage, the texture of the deposited film and the interaction between Cu and InP. This last point is necessary coupled to chemical surface analyses (XPS) of the semiconductor/metal interface. Our experimental results clearly showed two modes of growth for copper deposition onto n-InP depending on the polarisation range. The photoluminescence intensity is directly linked to the copper surface coverage. Consequently, a more cathodic applied potential, contributing to increase the density of copper nuclides, leads to a faster decrease of the photoluminescence signal (Fig. 2 and 3). This phenomenon seems to result from the initial mechanism of the nucleation. Another interesting point concerning the semiconductor/metal interaction will be presented. Indeed, a chemical interaction Cu/InP seems to remain after the dissolution of the copper film. Depending on the experimental conditions, the photoluminescence intensity may be completely restored ; or display an irreversible loss, whatever the subsequent electrochemical treatment. The repetition of the copper deposition on this modified surface will also be investigated.

- [1] G. Oskam, J.G. Long, A. Natarajan and P.C. Searson, J. Phys.D: Appl. Phys., 31, 1998.  
 [2] E.M.M. Sutter, I. Gérard, and A. Etcheberry, J. Electrochem. Soc., 146, (4) 1999

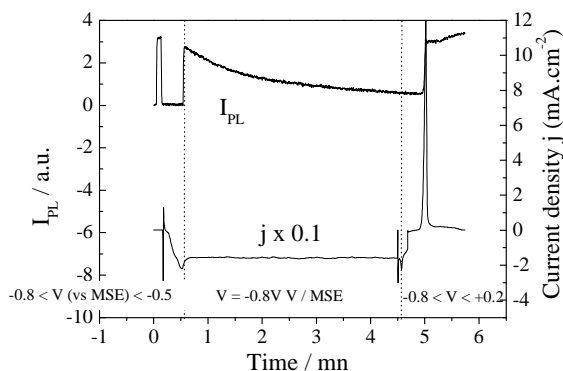


Fig.1 : Photoluminescence intensity and current density as a function of time

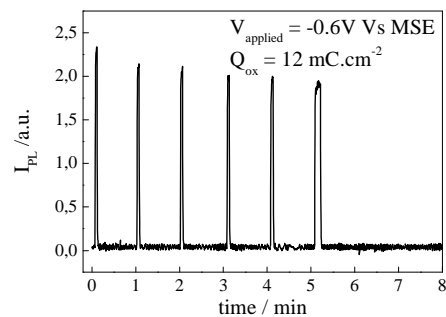


Fig. 2-a/ : Photoluminescence intensity as a function of time with an applied potential of  $-0.6V$  vs MSE.

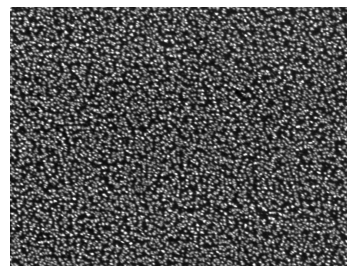


Fig. 2-b/ : MEB picture of n-InP after deposition of copper at  $-0.6V$ , magnified 2300 times.

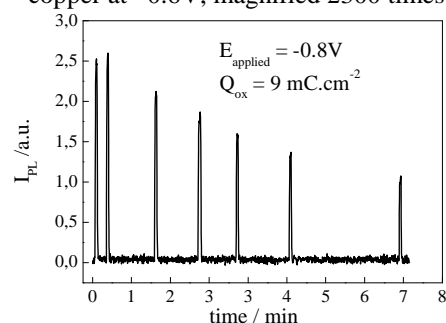


Fig. 3-a/ : Photoluminescence intensity as a function of time with an applied potential of  $-0.8V$  vs MSE.

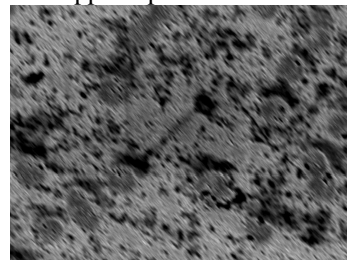


Fig. 3-b/ : MEB picture of n-InP after deposition of copper at  $-0.8V$ , magnified 2300 times.