

Comparison of the behaviors of GaAs and InP surfaces submitted to H₂ evolution. Contribution of a study by photoluminescence

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Hydrogen evolution at semiconductor electrode surfaces implies a very complex mechanism, which depends strongly on the semiconductor nature. Several years ago, H. Gerischer *et al.* [1] have established, on GaAs, that the first step of the global mechanism of the H₂ evolution induces a specific atomic hydrogen adsorption phenomenon. This H⁺ adsorption rules the behavior of the interface submitted to the H₂ evolution. For all the III-V binary compounds this intermediate step can modify more or less their surface chemistry giving rise to a side reaction: the cathodic decomposition. The amount of the implied material and the strength of this side process can differ strongly from one material to another. Even if modifications of the electrochemical behavior are generally observed, additional information are necessary to give an accurate description of the interface during the H₂ evolution. Using IR spectroscopy, Chazaviel *et al.* [2] have described the nature of the GaAs surface during the H₂ evolution. In the same way A. Gagnaire *et al.* [3] have described the strong decomposition of InP using ellipsometry. Photoluminescence can also be used as an *in situ* probe for studying this kind of mechanism. The very different behaviors of the GaAs and the InP surfaces can be perfectly followed and interpreted using this optical characterization. GaAs presents a rather stable PL intensity variation that is well described using the dead layer model [4,5,6]. However accumulation of potential scans in the H₂ evolution range generate a modification of the I (V) response associated to a small but reproducible decrease of the PL signal. Slight photo etching of the surface gives a complete recovery of both initial responses. For InP the PL cycle presents strong variations associated to each steps of the electrochemical process, evidencing the strong cathodic decomposition undergone by the InP surface. On the basis of this comparison the basic of the H₂ evolution on these III-V compounds will be discussed and the origin of the differences of the PL behaviour will be detailed.

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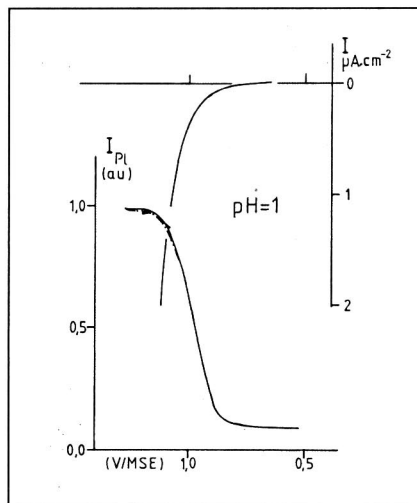


Fig.1: PL variation for hydrogen evolution on n-InP

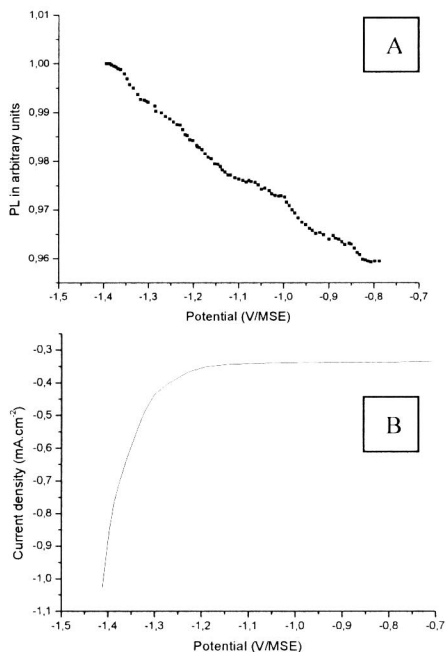


Fig.2 :

A: PL variation for hydrogen evolution on n-GaAs

B : I (V) of n-GaAs