

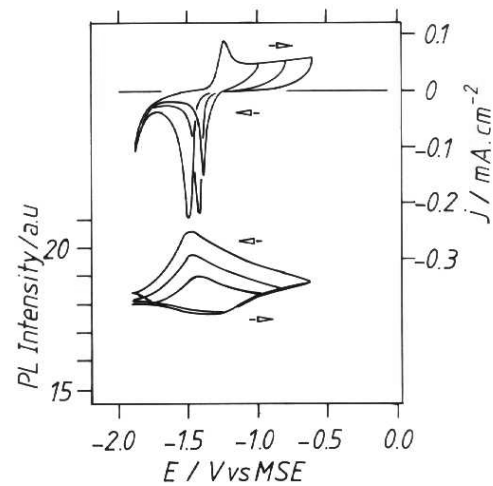
The Photoluminescence: An in-situ optical method for studying the Semiconductor Electrochemistry

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Electrochemistry at SC electrodes obeys to specific rules governed by the properties of an original interfacial layer formed by a space charge layer, a very sensitive surface and the double layer. Thus additional in-situ techniques are very useful to complete the information obtained by electrochemical measurements. Among the available techniques, Photoluminescence (PL) has a specificity on SC electrodes, due to its sensitivity to several parameters of the SC/Solution interface. So, PL intensity can be very sensitive to a lot of events that happen at the interface. Simulation of the intensity variations allows an accurate evaluation of the influence of the main parameters as the space charge layer width, the surface recombination velocity of the minority carriers, the optical parameters of the interface. It appears that in a lot of cases it is possible to interpret the PL variation by the main contribution of one parameter. Our purpose will be to justified this affirmation on the basis of the presentation of experimental results. We will present results about:

- the PL intensity variations that occur during the proton or water molecules reductions at n-InP. Each step of the electrochemical process can be evidenced. The H-surface interaction is suggested by PL enhancement; (In) apparition du to cathodic decomposition implies PL decrease; (In) transformation during the positive potential scan gives rise to specific PL intensity variations according to the dissolution or the transformation of the film see fig 1.

Fig1: Voltammograms of cathodically decomposed n-InP; pH= 9, PL variation is recorded at the same time. Influence of the high potential limit; features on the voltammogram is associated to the anodic then cathodic transformation of the surface In film. The charge associated to the smaller cathodic peak is $0.48 \cdot 10^{-3}$ C.



-The PL intensity variations that occur during the electrodeposition of metals on GaAs and InP. That give rise to specific variation associated to the amount but also to the growth conditions. The fig 2 illustrates this point for the copper deposition.

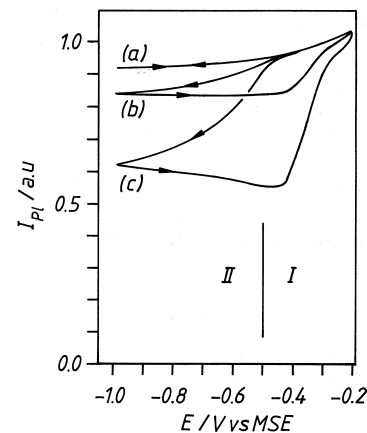


fig2: PL variation detected during the electrodeposition of copper on p-GaAs. Region I is associated to deposit region I to deposit dissolution; (a), (b), (c) correspond to different Cu^{2+} concentrations in H_2SO_4 solutions

The PL approach is also very interesting for electroless deposition as observed with Ag.

-The PL variations associated to band shifts occurring during anodic oxidation will be also discussed using results obtained on n-GaAs and n-CdTe