In-situ photoluminescence study of plasma effects on passivation of crystalline silicon coated with aluminum oxide or amorphous silicon

Mengkoing Sreng [1,2], François Silva [1,2], Pere Roca i Cabarrocas [1,2]*

[1] Institut Photovoltaïque d'Ile-de-France, 30 Route Départementale 128, 91120 Palaiseau, France

[2] LPICM, CNRS, Ecole Polytechnique, Université Paris-Saclay, 91128 Palaiseau, France

**corresponding author: mengkoing.sreng@ipvf.fr*

A degradation of surface passivation is generally observed after various plasma processes, e.g. deposition of amorphous silicon nitride by plasma-enhanced chemical vapor deposition (PECVD) or transparent conductive oxide by sputtering. To minimize such detrimental effect, a better understanding of the interaction between plasma species (radicals, ions, electrons and photons) and the passivation layer is necessary. Using our in-house in-situ photoluminescence set-up, the passivation quality of crystalline silicon wafers coated with aluminum oxide (Al_2O_3) grown by atomic layer deposition, or hydrogenated amorphous silicon (a-Si:H) grown by PECVD, is characterized in real time during argon-hydrogen plasma exposure. As shown in Figure 1, a quick increase of the photoluminescence signal, followed by a gradual degradation, is observed on as-deposited samples passivated by Al_2O_3. However, only degradation can be found on samples coated with a-Si:H. The interaction between plasma emission and different types of chemical bonds in the passivation layers is proposed to explain the obtained results. In addition, the relation between degradation rate and various plasma parameters (e.g. pressure, RF power and substrate temperature) is also studied.

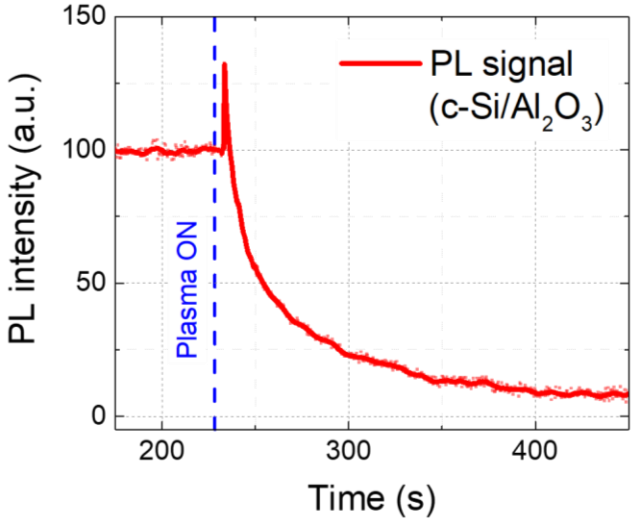

Figure 1: PL signal from c-Si passivated by Al_2O_3 during the Ar/H_2 plasma exposure