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Oxide semiconductors and related devices produced by high power impulse magnetron sputtering and selective area atomic layer deposition methods

Christy Fadel[1], Stéphane Cuynet[1], Claudia De Melo[1], Marcos Soldera[2], Jean-François Pierson[1], Frank Müklich[3], David Horwat[1]

[1]Institut Jean lamour, Nancy, France [2]Institut für Fertigungstechnik, Dresden, Germany [3]Lehrstuhl für Funktionswerkstoffe, Saarbrücken, Germany

christy.fadel@univ-lorraine.fr

Zinc oxide (ZnO) and Al-doped ZnO (AZO) are widely used as n-type semiconductors and transparent electrodes due to the abundance and low cost of Zn and Al in addition to their high optical and electrical properties. An important technique for depositing (AZO) films is the High Impulse Magnetron Sputtering (HiPIMS) method that allows us to deposit highly conductive and transparent films on large surfaces and at low temperatures [1]. Another important technique is the Atomic Layer Deposition (ALD) which is used for depositing high-quality films with excellent surface coverage on high aspect ratio structures; this method enables us to combine metallic Cu films with semiconductor oxides (ZnO, Cu_2O, or both) leading to many applications in different fields related with optoelectronics, catalysis, gas sensing and photovoltaics [2]. Cuprous oxide (Cu_2O) is a direct-gap semiconductor also used as an absorber in solar cells. The fabrication of segmented p-Cu_2O/n-ZnO nano-junctions is facilitated by selected area atomic layer deposition (SA-ALD). In this presentation, we report on the optimization of AZO layers synthesized by reactive HiPIMS [1], on the fabrication of devices based on p-Cu_2O/n-ZnO nano-junctions by a combination of HiPIMS and a SA-ALD method we have developed [2] and on the strategy we are developing, towards the fabrication of segmented textured solar cells based on such junctions.

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