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Cation and Anion co-doping of NiO for enhancing the UV-PV performance of NiO/TiO_2 heterostructures

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The increasing energy consumption, produced from fossil fuels, and consequently the increase in air pollutants have led to phenomena such as global warming (greenhouse effect) with the well-known effects on the environment and human health. Buildings are responsible for consuming about 40% of the total produced energy, while windows are responsible for the loss of 10-25% of the thermal energy of buildings **[1]**. A properly designed "smart window" can control and modulate solar heat and lighting and it is possible, at the same time, to produce and store solar energy. The emerging class of wide gap oxide semiconductors can be fabricated as transparent solar cells, harvesting UV radiation and integrated into optoelectronics as power producers **[2-4]**. Thus, transparent solar cells can be used for energy-autonomous "smart windows" like electrochromics.

In this presentation, undoped NiO, single doped NiO with niobium (Nb) and nitrogen (N) (NiO:Nb, NiO:N) as well as co-doped NiO:(Nb,N) were fabricated by rf sputtering by employing metallic Ni and composite Ni-Nb targets in plasma containing % (Ar - O_2 - N_2) gases. The p/n heterostructures were fabricated by employing the fabricated p-type NiO and n-type TiO_2, namely p-NiO/n-TiO_2, to be investigated as UV solar cells. The TiO_2 layers consisted of a double mesoporous/compact TiO_2 film fabricated by spin coating, on FTO-covered glass substrates according to the standard procedure followed when TiO_2 is used as electron transfer layers for perovskites PVs. The TiO_2/FTO/glass configuration was the substrate used for forming NiO:Nb/TiO_2 and NiO:(Nb,N)/TiO_2 heterostructures (Fig. 1). The oxide layers were characterized by AFM, SEM-EDX, XRD, Raman, XPS, Hall and Seebeck effect and UV-Vis-NIR spectroscopy whereas the behavior of the heterostructures was characterized in the dark and photo I-V under UV illumination.

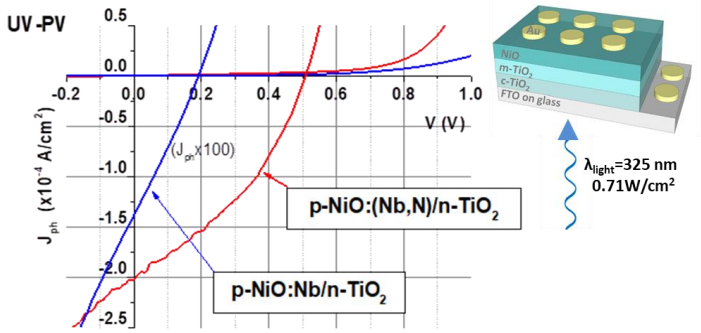

Figure 1: Dark and photo UV illumination

References

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