Graphene-based electrodes for non-conventional crystalline silicon solar cells

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Graphene is considered as a promising candidate for the new emerging generation of transparent electrodes to be used in many applications such as displays, touch screens and/or solar cells [1, 2]. Its unique mechanical, electrical and optical properties make it a relevant material in a near future [3]. In this work, a new design of transparent conductive electrode based on a graphene monolayer is evaluated by its incorporation into non-standard high-efficiency crystalline silicon solar cells, where the conventional emitter is replaced by a MoOx selective contact. The device characterization reveals a clear electrical improvement when the graphene monolayer is placed as part of the electrode. The current–voltage characteristics of the solar cells with graphene shows a higher FF and V_{oc} thanks to the improved sheet resistance. Figure 1 shows the electrical conductance maps acquired on das-Nano Onyx, using reflection-mode terahertz time-domain spectroscopy (THz-TDS), where the measurable frequency range analysed was from 0.1 THz to 5 THz. Improved conductance values of around 4.5 mS are achieved for the graphene-based electrode, in comparison with 3 mS, for bare ITO. These results so far clearly open the possibility to achieve a noticeably improvement in the contact technology and therefore to further enhance non-conventional photovoltaic technologies.

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References

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Figures

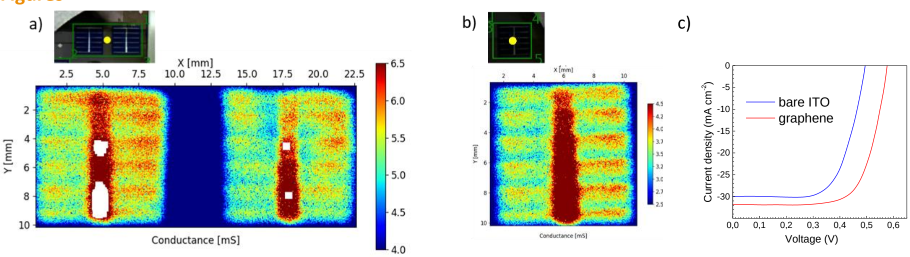

Figure 1: THz-TDS Conductance maps obtained for the solar devices. The areas in between the fingers have conductance around a) 4.5-5.5 mS (sample with graphene monolayer) and b) 3-3.5 mS (sample with bare ITO). The lines of higher conductance correspond to the metallic fingers. c) Compared electrical characteristics of the solar cells with bare ITO and adding a graphene monolayer.