Graphene/Silicon Schottky barrier solar cells

L. Lancellotti[(1)], E. Bobeico[(1)], A. Capasso[(2),(3)], E. Lago[(3)], P. Delli Veneri[(1)], N. Lisi[(2)]

[(1)]ENEA, Portici Research Center, P.le E. Fermi 1, 80055 Portici , Naples, Italy
[(2)]ENEA, Casaccia Research Center, I-00123 Rome, Italy
[(3)]Istituto Italiano di Tecnologia, Graphene Labs, I-16163 Genova, Italy
laura.lancellotti@enea.it

Abstract
A solar cell based on graphene in direct contact with a semiconductor substrate was proposed for the first time in 2009 [1]; later on, the formation of graphene/semiconductor Schottky barriers was experimentally verified, paving the way to graphene/silicon Schottky barrier solar cells [2].
In the present work, we produced few-layer graphene films by chemical vapor deposition and fabricated graphene/n-silicon solar cells (Fig.1). We increased the cell performance by three optimization steps. After the growth of graphene, we transferred it on pre-patterned silicon substrates with the aid of cyclododecane (i.e., a simple transfer method that preserve the intrinsic features of graphene [3]). We then doped the graphene film with nitrate and chlorine ions to increase its work function and electrical conductivity. Lastly, we deposited a double layer antireflection coating on the top of the device to reduce the optical losses due to the sunlight reflection [4]. The combination of these three optimization steps are reflected in the electrical performance of the solar cell. The optimized device reached a power conversion efficiency of 8.5% exceeding by a factor of 4 that of the undoped and uncoated device. Further investigations on graphene/silicon solar cells will offer the opportunity to attain even higher power conversion efficiencies in devices that are cost-effective and simple to fabricate.

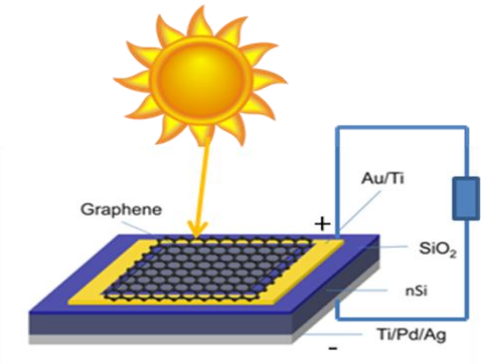

Figure 1:Schematic illustration of the fabricated graphene/silicon solar cell.

References

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