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Third generation solar cells emerged with the aim of developing efficient, easy processing and low cost solar cells. As titanium dioxide (TiO_2) is synthesized from abundant and inexpensive materials, it has been largely used as efficient electron transport layer in both Dye-Sensitized Solar Cells (DSSCs) and Perovskite solar cells.

Still, efforts remain to be performed to improve photo-current generation in these cells, especially concerning the development of efficient and reliable charge transporting electrodes and selective contacts. Indeed, titanium dioxide layer presents defects that trap electrons and favor electron-hole pair recombination. Thanks to good physical properties of carbon nanostructures (carbon nanotubes, graphene), developing composites of TiO_2 and carbon nanostructures as electron transport layer seems to be a relevant strategy for a better electron collection and therefore an optimal energy conversion in DSSCs or perovskite solar cells.

We use the original technique of laser pyrolysis to synthesize composites of TiO_2 with carbon nanostructures, in order to achieve high quality of nanocomposites presenting well-controlled physical properties suitable for efficient and stable solar cells. We recently demonstrated a significant increase in efficiency for solid-state dye-sensitized solar cells by incorporating carbon nanotubes in the TiO_2 mesoporous electrode.[1] Our current research is focused on the synthesis and optimization of TiO_2/graphene nanocomposites for perovskite solar cells. Particular attention is paid to material characterizations such as morphological and structural analysis as well as physical properties evaluation of the nanocomposites and their role and effects within solar cells.

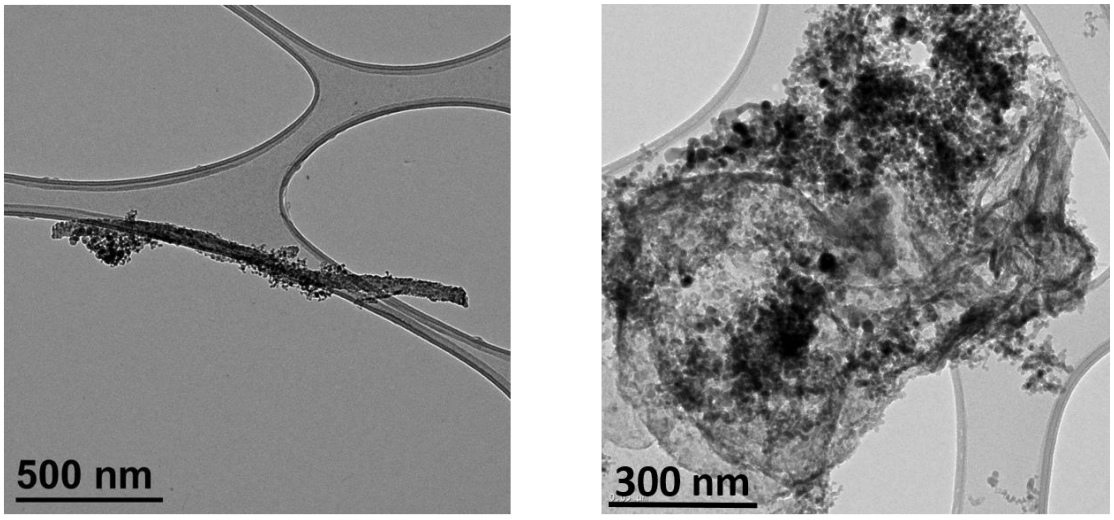

Fig1. TEM images of (a) TiO_2/Multi-walled carbon nanotube composite and (b) TiO_2/graphene nanocomposite synthesized by laser pyrolysis

[1] J. Wang et al., ACS Applied Materials & Interfaces 7 (2015) 51-56

Presentation Method: Invited Oral 20 minutes