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Advances in graphene materials photonics and optoelectronics

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Carbon-based nanomaterials are well known for their innumerable applications in all fields of science and technology. One of the most incredible carbon-based nanomaterial's in recent years is graphene, due to its amazing properties. Owning to its unique physical and chemical properties, this material is set to revolutionize the 21st century for its wide practical uses, such as, nano electronics, sensors, capacitors, solar cells, fuel cells, Li ion batteries, photo catalysis, electro catalysis, drug delivery and plasmonics. Since graphene was isolated by mechanical exfoliation in 2004, many promising properties have been reported, such as extremely high electron mobility. Furthermore, graphene's strong interactions with photons and electrons and chemical functionalization ability could add more functions to photoactive composites. Their optical properties can be easily modulated via many processes, treatments and/or interaction with other compounds. In this sense, the rise of graphene and its based materials in photonics and optoelectronics is shown by several recent results, ranging from solar cells and light-emitting devices to touch screens, photodetectors and ultrafast lasers. This work is reporting on the photonic and optoelectronic properties of graphene materials including discussions on the interaction between the different compounds based on the study of a couple of examples. Hence, graphene materials are suitable for many optical and optoelectronic applications including organic solar cells donor-acceptor systems.

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Laser induced graphene as electrode for 3rd generation solar cells

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Graphene has recently emerged as an alternative to ITO substrate as an electrode in solar cells structure. With its remarkable electrical, physical and chemical properties, and high degree of flexibility and transparency; it is considered as an ideal candidate for flexible 3rd generation solar cells, the graphene solar cells an eco-green technology is getting to the same level of ITO based solar cells. Laser Induced Graphene (LIG) method has been used and characterized on flexible substrate for flexible quantum dots sensitized solar cells. The Flexible quantum dots sensitized solar cells is composed of LIG as electrode and active layer combining a metal oxide layer for electron collection and quantum dots layer for light absorption and carrier generation. In this presentation, the role of LIG graphene in flexible solar cells will be presented.

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