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Novel chaclogenide and chalcohalide semiconductors for next generation thin film solar cells

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Our broad research focus is on the exploration of the emerging chalcogenide and chalcohalide based compound semiconductors for application in solar to energy conversion devices. The group leader Prof. Edgardo Saucedo have vast experience of developing kesterite (Cu2ZnSn(S/Se)4) based thin film photovoltaic technology and has made significant contribution in positioning IREC as a reference research center for this technology across the globe. In the year 2020 he was awarded with the ERC consolidator grant and since then he is leading his independent research group at UPC Campus Diagonal Besos Barcelona. Currently one of the main research lines of the group focuses on the synthesis of the novel Sb and Bi based quasi-1-D chalcogenide and chalcohalide compound semiconductors. These compound semiconductors are identified as potential candidate for the solar absorber application in thin film solar cell devices. In order to achieve this, we are working on developing new synthesis methodologies including the experiments with the above ambient pressure synthesis of chalcohalide compounds in thin film form. In-depth study of these materials will bring out the new insights which will benefit the community.

Another important research activity which is being pursued currently is the investigation of MXene/organic dipoles hybrid heterostructures for application as charge selective contacts in thin film solar cells. Even though such hybrid heterostructures have been recently carried out in perovskite and organic based solar cell technologies it is yet to be explored for chalcogenide based thin film solar cells. Hence the fundamental exploration of the interfaces of such hybrid 2D materials assembly with the quasi-1-D chalcogenide compounds will help in building a new understanding about the charge transport properties across the hetero-interfaces. In order to perform these research activities our laboratory is well equipped with the facilities to grow the thin films by PVD as well as through solution-based routes. For device characterization we have basic opto-electronic characterization tools and are in the process of developing some advanced techniques such as micro transmittance and photoluminescence.

In order to further bring out deeper understanding about the performance of these scarcely explored materials utilization of advanced characterization methods is prerequisite. We believe by taking part in this one-day workshop we will get opportunity to know about as well as understand the capabilities of the scientific infrastructure which will be made available for the scientific community through InCAEM. In addition to this it will provide a very nice platform to network with other research groups as well as explore the possibilities for establishing meaningful collaboration.

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