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Centre for Advanced Research in Sciences  
University of Dhaka  
Dhaka-1000

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## CARS SEMINAR SERIES

Speaker: **Dr. Md. Akhtaruzzaman**  
Professor, Solar Energy Research Institute  
Universiti Kebangsaan Malaysia (UKM)  
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Malaysia


Title: **Material Progress Towards Highly Efficient Organic-Inorganic Hybrid Solar Cells**

Venue: Conference Room (1<sup>st</sup> Floor), Center for Advanced Research in Sciences (CARS), University of Dhaka

Date: Tuesday, March 21 2023

Time: 12.00 pm

You are cordially invited to attend the seminar.

  
Ishtiaque M Syed, PhD  
Professor of Physics &  
Director  
Centre for Advanced Research in Sciences (CARS)  
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**Prof. Dr. Ishtiaque M. Syed**  
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## Material Progress Towards Highly Efficient Organic-Inorganic Hybrid Solar Cells

Md. Akhtaruzzaman

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Both the Bangladesh Sustainable and Renewable Energy Development Authority (SREDA) plan and the United Nations Development Programme (UNDP) Sustainable Development Goals (SDGs) emphasize the importance of lowering the cost of producing energy for the general public without compromising environmental quality. Solar for Health can contribute significantly to the 2030 Agenda for Sustainable Development and its commitment to "leave no one behind" by reaching out to remote and underserved communities. To fully realize the potential of solar energy, it is essential to design and integrate photovoltaic technology into fully functioning devices that are industrially marketable. In particular, the development of flexible organic-inorganic photovoltaic technology opens up the possibility of integrating solar energy into various smart appliances. Therefore, the organic-inorganic hybrid solar cells like perovskite solar cells (PSCs), dye-sensitized solar cells (DSCs), and bulk heterojunction solar cells (BHJSCs) or organic PV (OPV) draw huge attention towards the scientific community due to their lightweight, flexible, and colourful properties, as well as their ability to be integrated on window glass or plastic substrate by low-cost manufacturing processes like ink-jet printing or roll-to-roll process. However, some existing limitations like reproducibility, water and ambient moisture instability, carrier recombination, expensive counter-electrode (e.g. Au), oxygen/moisture sensitivities of the electron transport layer, low-hole carrier mobility, poor crystallinity, and solubility restrict their commercialization. Furthermore, a lot of the converted photon energy was lost to thermalization or carrier trapping because of the extended injection time of the hole and the electron in the organic-inorganic interface. Common doping and additives used in PSCs and DSCs are hygroscopic, which reduces stability and efficiency. So there are a lot of challenges that remain to further enhance the operational stability of such kinds of solar cells. A lot of promising research has been going on such as interface modification of the ETL or HTL/absorber layer, tuning of the crystallinity, morphology, defect engineering, and new materials development to enhance device stability and efficiency for practical applications.



**Short Bio:** Dr. Md. Akhtaruzzaman is a Professor at the National University of Malaysia, where he is leading the Organic-Inorganic Hybrid Solar Cells Unit at Solar Photovoltaics group. He is a visiting lecturer at Tsukuba University and Akita University in Japan. After receiving his BSc (Bachelor of Science) in 1996 and MSc (Master of Science) in 1998 in Applied Chemistry and Chemical Engineering from the University of Dhaka, Bangladesh, he has been awarded the Japanese Government's Monbukagakusho Scholarship and joined the Institute for Molecular Science (IMS) in Okazaki, Japan, where he obtained his PhD and

studied on the design and synthesis of new organic heterocyclic compounds for EL device application. Thereafter, he worked in Japan for 12 years (Tokyo Institute of Technology, Fujifilm Fine Chemicals Co. Ltd., and Tohoku University), King Saud University in Saudi Arabia, and the University of Malaya (UM) in Malaysia. As a recognition of his hard work and dedication to his academic career at UKM, he has been honoured with several prestigious awards from MyRA (Malaysian Research Assessment) for his outstanding contributions to the fields of research, scholarly publication, student supervision, and institutional service. His areas of expertise are the rational design of organic/inorganic semiconductors, Nano-materials for various applications, including Dye-sensitized Solar cells (DSSCs), Perovskite thin film solar cell, Quatum dots-based Hybrid solar cells, Bulk-heterojunction Solar cells (BHJs) or Organic PV (OPV), Light-Emitting Organic Field-effect Transistors (LE-OFETs), Organic Thin Film Transistors (OTFTs), Flexible Memory Devices, and has published over 180 papers, reviews in peer-reviewed journals, patents, and book and book chapters. He has also been serving as the project leader as well as co-researcher for many governments (Malaysia) and international (Saudi National Grant, Madinah University grant, Qatar Foundation, etc.) funded projects.