

International E-Conference on

# RENEWABLE ENERGY AND RESOURCES

April 26, 2021 | Webinar



**Varun Vohra, Shusei Inaba, Ayumu Kiyokawa, Tomoaki Takada**

University of Electro-Communications, Japan

## Green & sustainable methods or materials for next-generation photovoltaic device fabrication

Unlike conventional silicon-based photovoltaic technology, organic solar cells (OSCs) can be prepared as semi-transparent or flexible devices and thus display a great potential as next-generation integrated renewable energy technology. However, in addition to the relatively short lifetime of OSCs, conventional OSC fabrication results in a large amount of costly materials and hazardous solvent wastes. The objective of our research is to find innovative green & sustainable solutions for the fabrication or recycling of efficient OSCs. Here, we present two methods to considerably reduce the amount of wasted materials generated during the OSC fabrication or when discarding degraded OSCs. OSC active layers are conventionally fabricated using spin-coating, a deposition technique expels large amounts of costly material and hazardous solvent released in the environment. We developed the push-coating method, in which uniform thin films are produced by spreading small volumes of organic semi-conductor solutions between the substrate and a stamp through capillary forces. This fabrication process does not generate any active material waste and minimizes the use of hazardous solvents. We verified whether push-coating can be applied to OSC fabrication with several state-of-the-art active materials. The second method we focus on is the recycling of costly substrates from degraded OSCs. We demonstrate that with the proper cleaning sequence, the degraded active layers can be removed and the zinc oxide coated indium tin oxide substrates can be reemployed multiple times for the fabrication of new OSCs without major drops in power conversion efficiency. Our results thus considerably decrease the environmental impact of OSC fabrication and elongate the lifecycle of the metal oxide substrates, thus opening the path to sustainable OSC manufacturing.

**Keywords:** emerging photovoltaics, sustainable manufacturing, thin film, organic semiconductors, organic solar cells, recycling

### Biography:

Varun Vohra is a French researcher who completed his PhD in Materials Science from the University of Milan-Bicocca in 2009 at the age of 25. He was a EU Marie-Curie Fellow (2006~2009) and a JSPS Post-doctoral Fellow (2011~2014) before joining the University of Electro-Communications (UEC) in 2014. He established his research group focusing on organic solar cells (OSCs) at UEC, where he obtained tenure as Associate Professor in 2019. He pioneered in fabricating OSCs with efficiencies over 10% and has authored over 40 academic publications including papers on prestigious journals such as *Nature Photonics*.