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Oxide semiconductor plasmonics in the infrared range for modern life

Doped oxide semiconductors have received much attention for emerging surface plasmons in the infrared (IR) region. Recently, oxide semiconductors such as In2O3, ZnO have been launched as new plasmonic nanomaterials. Recently, our group reported surface-enhanced optical spectroscopes with a view to developing new sensing platforms. In this work, we focus on plasmonic response of doped oxide semiconductors with a view to providing valuable strategies for the development of new optical functionalization related to energy-saving technology for window applications. In this presentation, we report surface plasmonic properties of doped transparent oxide semiconductors in addition to those of noble metals such as Au and Ag, and then their thermal shielding applications in the IR region. In particular, three-dimensionally assembled ITO NP nanosheets showed high selective light reflection in the NIR region as a consequence of plasmon coupling between the NPs. A spatial gap between NPs is induced strong electric fields, which is related to a near-field effect on NP surfaces. This near-field phenomenon effectively produces plasmon resonances in the NP nanosheets, which acted as thermal shielding in the IR solar light. This study introduces surface plasmons on oxide semiconductor NPs as one of size-dependent properties for energy-saving applications.

Biography

Hiroaki Matsui has completed his PhD at the age of 28 years from Saga University in 2001. He was a Post-Doctoral research fellow, and in 2001 - 2005, he became Research Associate at ISIR-Sanken in Osaka University. From 2005 to 2008, he joined the Organization for the Promotion of Research on Nano-science and Nanotechnology at Osaka University. In 2008, he moved as Research Associate at University of Tokyo. In 2011, he has been Assistant Professor at the University of Tokyo. In 2017, he was promoted to associate Professor at the University of Tokyo.

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