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Plasmonic photocatalyst: Hot electron transfer type and hot hole-transfer type

Silver and gold nanoparticles (NPs) possess strong and broad absorption in the visible region due to the localized surface plasmon resonance (LSPR). In the heteronanostructures consisting of the plasmonic metal and n-type semiconductor (n-SC), the LSPR excitation of the former can generate hot electrons inducing the interfacial electron transfer to the latter (Scheme 1). The so-called plasmonic photocatalysts taking advantage of this phenomenon have attracted much attention particularly in terms of the application to artificial photosynthesis. Also, we have reported the synthesis of Au(core)-CdS(shell) half-cut nanoegg type plasmonic photocatalyst and its application for the red-light driven water splitting.1 With the formation of the hot-electrons, the excitation of the LSPR generates hot-holes simultaneously. So far, the hot holes have not attracted much attention. By using p-type semiconductor (p-SC) as the supporting electrode, the LSPR-induced hot-hole-transfer from Au to electrode was recently reported.2 The phenomenon expects us to realize the novel plasmonic photocatalyst so called “hot hole transfer type”. On the hot-hole type, a reduction reaction would proceed at the surface of the plasmonic metals. Thus, many electrocatalyses on the metal surface can be applied. In addition, the reductive nature enables the utilization of the easy oxidizing metals, such as silver and copper. In this talk, I would like to present the hot hole-transfer type plasmonic photocatalyst consisting of Au and nickel oxide for the overall water splitting by using red- or NIR-light.

Biography

Shin-ichi Naya is currently working as the technical staff of Environmental Research Laboratory at Kindai University, Japan. He received his PhD in Waseda University in 2001. After a postdoctoral training in 2001-2006, he joined Kindai University since 2007. Current research focuses on hetero-nanostructure of plasmonic photocatalyt.

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