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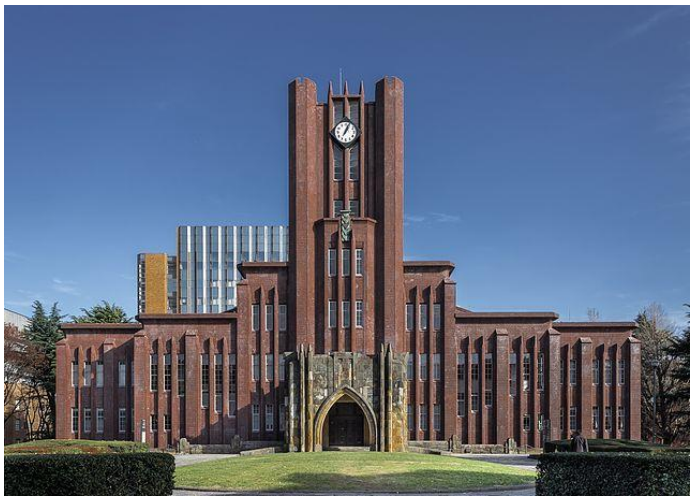
Energy harvesting from solar light by nano structural controlled iron oxide thin films

Hitoshi Tabata

University of Tokyo, Japan

Abstract

Iron oxides are environmental and human-friendly materials. They show various electrical, optical and magnetic properties. Highly spin polarized electron conductivities and unique photovoltaic behaviors are reported in a view point of spintronics technology. The efficient use of solar energy is now one of the great challenges in science and technology. In these days, variety materials have been investigated for use as photo-anodes for water-splitting by sunlight. Among these materials, ferrite oxide such as Fe_2O_3 and Fe_3O_4 are regarded as a promising system because of their probabilities of bandgap engineering, which lie well within the visible-IR spectrum, as well as their low costs, electrochemical stabilities and environmental compatibilities. Therefore, a considerable number of studies have been performed on the photoelectrochemical (PEC) properties of α-Fe_2O_3. We have demonstrated that enhanced photocurrent in Rh-substituted α-Fe_2O_3 thin films are grown by a pulsed laser deposition. The Rh-substituted and V-substituted α-Fe_2O_3 films were grown on α-Al_2O_3 (110) substrates with a Ta-doped SnO_2 electrode layer by pulsed laser deposition. The optical absorption spectra of the films indicate narrowing of the bandgap with increasing Rh and/or V content. Consequently, the photoelectrochemical performance was improved in the Rh, V-substituted films. We found that the optimum Rh content lies at around x=0.2, where the photocurrent is significantly enhanced over a wavelength range of 340–900 nm. The findings of this research are expected to be useful in the development of the solar fuel conversion systems based on α-Fe_2O_3.



Biography:

Hitoshi Tabata received his PhD in 1993 from Osaka University. He was a Professor of Nano- science and Nano-technology Center at Osaka University from 2002 to 2006. After 2006, he became a Professor at The University of Tokyo. He is Vice Chair of Department of Bioengineering and Director of International Center for Nano Electron and Photon Technology. He has published more than 200 papers in reputed journals and has been a Fellow of Japan Society of Applied Physics.

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