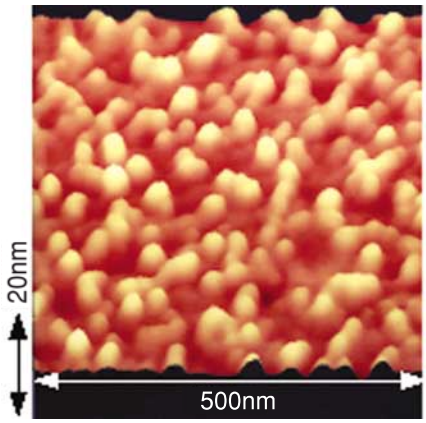
Metal / Semiconductor Hybrid Nano-Material

An extremely large magnetoresistance effect has been discovered in hybrid granular films, consisting of metal nano-clusters grown on a GaAs semiconductor substrate. The hybrid nano-material exhibits magnetic-field-sensitive current-voltage characteristics. More than 10000% change of the resistance, which we term magnetoresistive switch, is driven by the currentdecrease under the magnetic field of about 1000 Oe at room temperature. The hybrid granular films afford great promise in terms of applications such as a high-sensitive magnetic field sensor.



Typical atomic force microscopy image of metallic MnSb nanoclusters grown on a semiconducting GaAs substrate. The yellow bump corresponds to each nanocluster.

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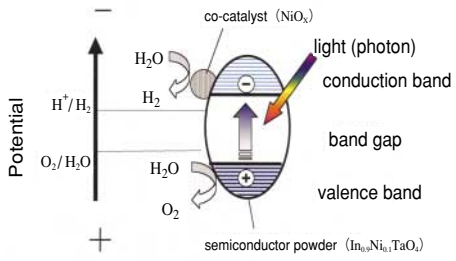
Direct Splitting of Water with Visible-Light Photocatalyst

- Artificial Photosynthesis for Light Energy Conversion -

Photocatalyticly splitting water utilizing solar energy to generate "clean-energy" hydrogen and taking advantage of the photosynthetic process as green plants for direct H_2 production have been a dream of mankind for several decades. The UV light only accounts for about 4% of the solar energy spectrum, while visible light forms about 43%, which is as much as 10 times of the UV light region. As most green plants use a photosynthetic process from water utilizing visible light, the research and development of visible light responding photocatalyst is crucial for the practical applications. Recently, water was successful split directly into stoichiometric H_2 and O_2 (mol ratio of $H_2/O_2 = 2$) under visible light irradiation ($\lambda > 420$nm) using NiO_y (partly oxidized Ni) or RuO_2 loaded $In_{1-x}Ni_xTaO_4$ photocatalyst powder as shown in Fig. We demonstrate the efficient evolution of stoichiometric H_2/O_2 mixtures from pure water under visible light irradiation ($\lambda > 420$nm) using these photocatalysts. The quantum was estimated to be 0.66%.



Photocatalytic H_2 and O_2 evolutions from pure water on $NiO_y/In_{1-x}Ni_xTaO_4$ and $RuO_2/In_{1-x}Ni_xTaO_4$ (x = 0-0.2). 0.5g powder sample was suspended in 250 ml pure water in a Pyrex glass cell under visible light irradiation (λ >420 nm). Light source: 300 W Xe lamp.

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