

研究概要

テーマ名：

強誘電体(Pb,La)TiO₃エピタキシャル薄膜を用いた無バイアス光電気化学反応に関する研究

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テーマ（英文）：Bias-free photoelectrochemical (PEC) fuel production using epitaxial ferroelectric (Pb,La)TiO₃ (PLT) thin films

研究内容： The main concern is to develop photoelectrode materials to boost up the performance of photoelectrochemical (PEC) “Solar-to-Fuel (H₂ or CO)” cells by using a novel ferroelectrics, epitaxial (Pb,La)TiO₃ (PLT) thin films as a base material. Currently, there are lots of efforts on PEC cells for fuel production. However, to achieve a true meaning of Solar-to-Fuel conversion, the reaction should be conducted under bias-free condition where only the solar energy is consumed. Ferroelectric epitaxial PLT thin films enable the bias-free PEC fuel production because they exhibit enormous photopotentials larger than the required potential. Moreover, 2-D TiO_{2-δ} nanosheet (NS) is an excellent source for photogenerated charge carriers, if being coated on the surface. Building a heterojunction of PLT and TiO_{2-δ} makes a smooth movement of charge carriers. The NSs have such a large effective area, that they are favorable for more vigorous PEC reactions, as well. To sum up, PLT provides driving forces for H₂ and CO productions under the bias-free condition, and further performance enhancement can be realized by coating TiO_{2-δ} NSs.