

PSW2 : 산화물 기반 미래 신소재 연구회 심포지엄**PSW2-1 | $\text{LaAlO}_3/\text{SrTiO}_3$ 이종구조에서 2차원 전자가스의 가역적 광조절**양경모¹, *이형우¹¹아주대학교

Long-lived photo-induced changes of electrical conductance in $\text{LaAlO}_3/\text{SrTiO}_3$ (LAO/STO) heterostructures enable their use in optoelectronic device applications. However, it still remains challenging to quench the persistent photoconductivity (PPC) instantly and reproducibly, which limits the reversible optoelectronic switching. In this study, we report a reversible photo-modulation of two-dimensional electron gas (2DEG) in LAO/STO heterostructures with high reproducibility. We gradually transformed the 2DEG at the LAO/STO interface to PPC states by irradiating UV pulses. Notably, the PPC states were completely recovered to the initial state by a water treatment, when two important requirements are met: (1) the moderate oxygen deficiency in STO and (2) the minimal band edge fluctuation at the interface. Through X-ray photoelectron spectroscopy (XPS) and electrical noise analysis, we verify that the reproducible change in the conductivity of 2DEG is directly due to the surface-driven electron relaxation in the STO substrate. These results pave the way towards developing optoelectronic memristive devices based on oxide 2DEG systems.