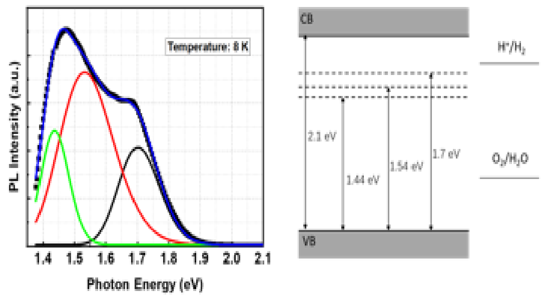
Seminarankündigung

Freitag, 23. November 2018
13:00 Uhr

WSI, Seminarraum S 101

“Defects properties of tantalum nitride”

Harvesting the abundant and renewable solar energy is one of the most promising means of meeting society’s ever-growing energy demand in a sustainable manner. Direct conversion of solar energy into chemical fuels can meet the challenge created by the intermittent nature of sunlight, thereby complementing to the conventional photovoltaic technology to achieve high market penetration. The ideal methodology for solar fuels production is based on the photochemical splitting of water. The extensive research efforts in the past decade has led to the recognition that Z-scheme system that couples a photoanode and a photocathode for water oxidation and reduction respectively is a more realistic way for efficient solar-driven water splitting. The main problem here is associated with oxygen evolution at the photoanode due to the need to transfer multiple electrons. Aside from developing novel catalysts for efficient oxygen evolution, find a semiconductor that can absorb a wide range of solar spectrum while at the same time provide enough driven force for water oxidation is a non-trivial task. Over the years tantalum nitride (Ta3N5) has emerged as a promising photoanode material for solar-driven water splitting. It has a wide visible light absorption range of up to 600 nm and a proper band position for water splitting. Photocurrent approaching the theoretical value of ~13 mA/cm2 has already been demonstrated. However, the onset potential of the photoanode is still very high, which limits its overall solar energy conversion efficiency to below 2.5%. Surface and bulk related defects in the material are probably the reason behind the high onset potential. In this study, we employed low-temperature and time-resolve photoluminescence spectroscopy to study the intrinsic defects properties of Ta3N5 (see figure), which in turn would help us to tune the defects properties by controlling the synthesis conditions or by external doping. Gradient doping of Mg and Zr in Ta3N5 thin film is found to be effective to suppress native defects density and create new shallow level defects, resulting in much improved PEC performance.



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