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Unusual electronic phase transition in hydrogenated TiO2 thin layer CHUNLEI YUE, JIN HU, XUE LIU, ZHIQIANG MAO, JIANG WEI, Tulane Unversity — Hydrogenated TiO2 has been studied intensively in recently years for its effectiveness of engineering band gap by introducing the hydrogen doping level close to the conduction band edge. Consequently, significant improvement of solar absorption efficiency has been achieved and has been successfully showcased in the photovoltaic and photocatalytic applications. Although the room temperature optical enhancement is fascinating, the comprehensive electronic properties of such hydrogenated TiO2 have hardly been investigated. Here we report our electric transport measurement of hydrogenated TiO2 thin layer in the temperature range from 400K to 3.5K. We observed a stabilized metallic behavior of hydrogenated TiO2, which persists down to 50K, and then a surprising transition to an insulating phase between 50K and 20K. Furthermore, the insulating phase of hydrogenated TiO2 shows a photocurrent response up to 4 orders magnitude. We interpret the possible mechanism as the transition of O-H vibrational modes, which leads to the freezing of electrons donated by the intercalated hydrogen.

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