

Abstract Submitted  
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**Observation and Characterization of Biexciton States in high-quality Monolayer WS<sub>2</sub>**<sup>1</sup> MITSUHIRO OKADA, Nagoya Univ, YUHEI MIYAUCHI, Kyoto Univ, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, KAZUNARI MATSUDA, Kyoto Univ, HISANORI SHINOHARA, RYO KITaura, Nagoya Univ — Group-VI transition metal dichalcogenides (TMDCs) have attracted a great deal of attention due to the optical properties dominated by excitonic effects, where emissions in PL arise from excitons and trions are seen even in room temperature (RT). In recent studies on PL emissions from WS<sub>2</sub>, one of TMDCs has shown that even biexcitons can be observed at 4 K with high-power excitation of 50,000 W/cm<sup>2</sup>. In this work, we report the observation of biexciton states at temperature higher than 80 K with excitation power lower than 25 W/cm<sup>2</sup>, by using a high-quality monolayer WS<sub>2</sub> grown directly onto the hBN. PL spectra of the WS<sub>2</sub>/hBN measured at RT show a very sharp excitonic PL emission with a FWHM of 21.5 meV, and at 82.7 K the PL spectra show three additional peaks at the lower energy site. The excitation power dependence and the lifetime measurement of PL peak at 2.00 eV clearly show that this PL peak can be attributed to biexcitons, which has been observed with a low excitation power down to 24 W/cm<sup>2</sup>. We think that the minimal amount of trapping sites in high-quality WS<sub>2</sub>/hBN used is a key factor in the observation of biexcitons at over 80 K and a low excitation power.

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