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Photoluminescence mapping of grain boundaries in CVD-grown MoS_2 monolayers YUMENG YOU, AREND VAN DER ZANDE, DANIEL CHENET, Columbia University, New York, NY, PINSHANE HUANG, Cornell University, Ithaca, NY, JAMES HONE, Columbia University, New York, NY, DAVID MULLER, Cornell University, Ithaca, NY, TONY HEINZ, Columbia University, New York, NY — Monolayer MoS_2 is an atomically thin 2-D material with a direct energy gap. Recently, rapid progress has been made in the growth of this material by chemical vapor deposition (CVD). Here we apply photoluminescence (PL) mapping to study monolayer MoS_2 samples prepared by CVD. For appropriate growth conditions, MoS_2 monolayers can be grown that exhibit well-defined boundaries between different crystal domains. Using electron microscopy, we have identified boundaries between crystals of different orientation and between mirror-twin crystals. PL mapping has been found to permit the ready identification of both of these boundaries through shifts in the strength and energy of the emission peaks. This sensitivity renders PL imaging a convenient tool for the identification of grain boundaries that remain hidden in conventional optical microscopy. The strong structural modification of material at a grain boundary extends for only around 1 nm. Thus only slight variation in the PL might be anticipated, given the excitation laser spot size of around 500 nm. We will discuss the possible physical origins of the strong contrast observed in the PL maps, including the role of exciton diffusion to the grain boundaries.

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