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Exction-related electroluminescence from monolayer MoS_2 YU YE, ZILIANG YE, MAJID GHARGHI, HANYU ZHU, MERVIN ZHAO, XIAOBO YIN, XIANG ZHANG, University of California Berkeley — Excitons in MoS_2 dominate the absorption and emission properties of the two-dimensional system. Here, we study the microscopic origin of the electroluminescence from monolayer MoS_2 fabricated on a heavily p-type doped silicon substrate. By comparing the photoluminescence and electroluminescence of a MoS_2 diode, direct-exciton and bound-exciton related recombination processes can be identified. Auger recombination of the exciton-exciton annihilation of bound exciton emission is observed under a high electron-hole pair injection rate at room temperature. We expect the direct exciton-exciton annihilation lifetime to exceed the carrier lifetime, due to the absence of any noticeable direct exciton saturation. We believe that our method of electrical injection opens a new route to understand the microscopic nature of the exciton recombination and facilitate the control of valley and spin excitation in MoS_2.

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