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Annealing and adsorption effects on MoS2 electronic properties ALARIC BERGERON, Polytechnique Montreal, ALEXANDRE FAVRON, RICHARD MARTEL, RICHARD LEONELLI, Universite de Montreal, SEBASTIEN FRANCOEUR, Polytechnique Montreal — Monolayers of MoS_2 and other transition metal dichalcogenides open up a number of promising opportunities in the fields of spintronics and flexible electronics. However, the properties of these 2D semiconductors are often altered by interactions with their environment that modify significantly their electrical behavior and their optical response. In this work, we investigated the influence of 1) laser annealing, 2) adsorbed gas molecules and 3) substrate characteristics on electronic states and properties of MoS_2 monolayers through low-temperature spatially resolved photoluminescence. We find that laser annealing suppresses low-temperature bound exciton and trion photoluminescence, as well as decreases the relative intensity of the B-exciton photoluminescence. The use of a polymer substrate enables a permanent five-fold enhancement of the room-temperature photoluminescence of the monolayer by laser annealing. This suggests that adsorbed molecules have a significant effect on doping levels. Further studies through annealing in different atmospheres allowed us to link this effect to specific adsorbates. Finally, MoS_2 monolayers were encapsulated in polymer to maximize the photoluminescence enhancement by completely shielding the surface from surrounding gas molecules.

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