Transition from semiconductor to metallic behavior in monolayer and bilayer of MOS2 by substrate change Si to Au.

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Transition metal dichalcogenides *TMDCs* which have the general formula MX2, where M represents a transition metal, while X stands for a chalcogen, drawn considerable efforts from the researchers in the last decade. In spite the existence of more than forty species of TMDCs, only MoS2, MoSe2, WS2 and WSe2, were strongly studied up to these days. It is due to the fact that the mentioned species presents a semiconducting character, with a considerable band gap, which turn these TMDCs very attractive for applications as semiconductor devices. Using mechanical exfoliation or chemical vapor deposition *CVD* method it was possible to obtain few or even single layers of these Van Deer Walls solids to build devices such as transistors, or even integrated circuits. Furthermore, the transition in the band gap nature, from indirect in few layers for direct in the single layer, make these materials very interesting for optoelectronic purposes. Devices based in p-n junctions, phototransistors and photodiodes are examples of the potential of semiconducting TMDCs for optoelectronic devices. In this work, we used Electrostatic force microscopy *EFM* and conductive atomic force microscopy *CAF M* in order to investigate the change semiconductor-metal behavior in sample of MoS2 caused by substrate difference. The measure were obtained in monolayer 1L, bilayer 2L, trilayer 3L and few layers FL MoS2, on Au and Si substrate. The EFM contrast image revel the presence of surface charge on 1L, 2L, 3L and FL with the absence of surface charge in 1L and 2L. The CAFM measures show the ohmic behavior and high intensity of vertical electric current for 1L and 2L. However, for 3L and FL the current have a lower intensity and nonlinear I x V behavior.