Highlights

ACTIVITY F Electronic and thermal transport from the nanoscale to the macroscale 2020

Electron irradiation of metal contacts in monolayer MoS_2 Field-Effect Transistors

Aniello Pelella[1,2], Osamah Kharsah[5], Alessandro Grillo[1,2], Francesca Urban[1,2,3], Maurizio Passacantando[4], Filippo Giubileo[2], Laura Iemmo[1,2], Stephan Sleziona[5], Erik Pollmann[5], Lukas Madauß[5], Marika Schleberger[5], and Antonio Di Bartolomeo[1,2]

[1] Department of Physics and Interdepartmental Centre NanoMates, University of Salerno, via Giovanni Paolo II, Fisciano, 84084, Italy
[2]CNR-SPIN Institute of Superconductors, Innovative Materials and Devices, UOS-Salerno, Italy
[3] INFN – Gruppo collegato di Salerno, via Giovanni Paolo II, Fisciano, 84084, Italy
[4] Department of Physical and Chemical Sciences, University of L'Aquila, and CNR-SPIN L'Aquila, via Vetoio, Coppito, L'Aquila, 67100, Italy
[5] Fakultät für Physik and CENIDE, Universität Duisburg-Essen, Lotharstrasse 1, D-47057, Duisburg, Germany

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Metal contacts play a fundamental role in nanoscale devices. In this work, Schottky metal contacts in monolayer molybdenum disulfide (MoS_2) field-effect transistors (FETs) are investigated under electron beam irradiation. It is shown that the exposure of Ti/Au source/drain electrodes to an electron beam reduces the contact resistance and improves the transistor performance. The electron beam conditioning of contacts is permanent, while the irradiation of the channel can produce transient effects. It is demonstrated that irradiation lowers the Schottky barrier at the contacts, due to thermally induced atom diffusion and interfacial reactions. The simulation of electron paths in the device reveals that most of the beam energy is absorbed in the metal contacts. The study demonstrates that electron beam irradiation can be effectively used for contact improvement through local annealing.

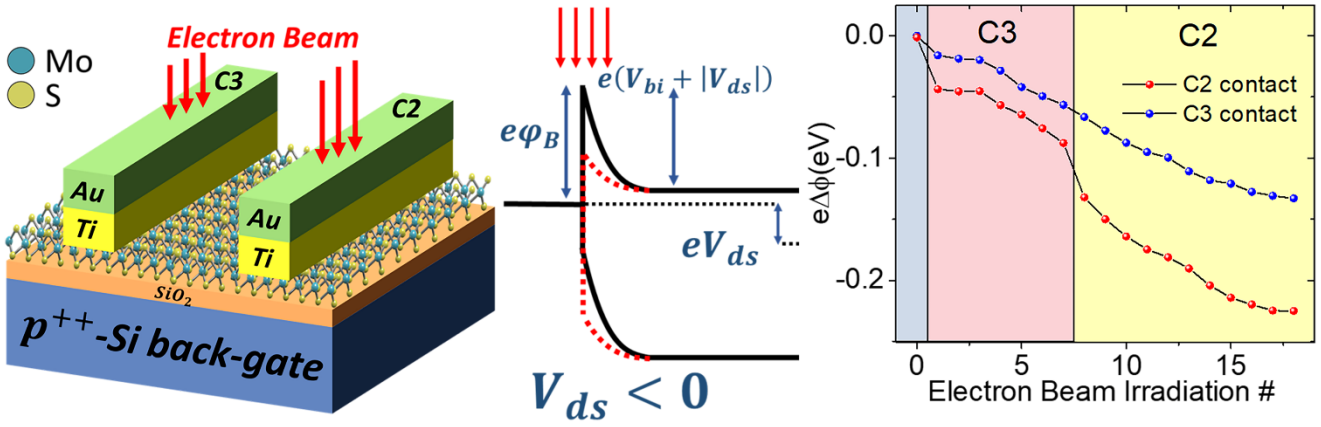

Fig. 1: (a) MoS_2 FET layout. (b) Low-bias energy band diagrams (black) and modification under electron irradiation (red) of contact, resulting in barrier lowering ($\bar{\varphi}_B$). (c) Zero-bias Schottky barrier variation at the contact C2 and C3 as a function of the irradiation number.