Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Integrated circuits and logic operations with high room temperature voltage gain based on single-layer MoS_2 ANDRAS KIS, BRANIMIR RADISAVLJEVIC, MICHAEL WHITWICK, EPFL — Two-dimensional materials such as single-layer MoS2 represent the ultimate limit of miniaturization in the vertical dimension, are interesting as building blocks of low-power nanoelectronic devices and are suitable for integration due to their planar geometry. Because they are less than 1 nm thin, 2D materials in transistors could also lead to reduced short channel effects and result in fabrication of smaller and more power efficient transistors. Here, we report on the first integrated circuit based on a two-dimensional semiconductor MoS2. Our integrated circuits are capable of operating as inverters, converting logical "1" into logical "0", with room-temperature voltage gain higher than 4.5, making them suitable for incorporation into digital circuits. We also show that electrical circuits composed of single-layer MoS2 transistors are capable of performing the NOR logic operation, the basis from which all logical operations and full digital functionality can be deduced. We have also fabricated suspended single-layer MoS2 membranes and have performed mechanical measurements using an atomic force microscope. Our results show that single-layer MoS2 has a Young's modulus higher than steel and can withstand deformation up to 11%, making it suitable for integration with flexible electronic devices.

Andras Kis
EPFL

Date submitted: 10 Nov 2011 Electronic form version 1.4