Single-layer MoS2 nanopores as nanopower generators

Presenting Author :Aleksandra Radenovic
Co-Authors: Feng, M. Graf, K. Liu, D. Ovchinnikov, D. Dumcenco, A. Kis, M. Heiranian, V. Nandigana, and N. R. Aluru
Organization, Laboratory of Nanoscale Biology, Institute of Bioengineering, School of Engineering, École Polytechnique Fédérale de Lausanne

Contact@E-mail:aleksandra.radenovic@epfl.ch

Atomically thin nanopore membranes are considered to be a promising approach to achieve single base resolution with the ultimate aim of rapid and cheap DNA sequencing. In this talk I will address novel applications that address identification of single nucleotides but as well go beyond DNA sequencing. We use novel solid state nanopore platform based on atomically thin nanopore membranes in 2D materials such as graphene or molybdenum disulfide for DNA detection, sequencing, water desalination and osmotic power generation. Making use of the osmotic pressure difference between fresh water and seawater is an attractive, renewable and clean way to generate power and is known as 'blue energy'.For this task, membranes made of two-dimensional materials are expected to be the most efficient, because water transport through a membrane scales inversely with membrane thickness. We demonstrated the use of single-layer molybdenum disulfide (MoS_2) nanopores as osmotic nanopower generators. We observe a large, osmotically induced current produced from a salt gradient with an estimated power density of up to 106 watts per square metre—a current that can be attributed mainly to the atomically thin membrane of MoS_2. Low power requirements for nanoelectronic and optoelectric devices can be provided by a neighbouring nanogenerator that harvests energy from the local environment. We use our MoS_2 nanopore generator to power a MoS_2 transistor, thus demonstrating a self-powered nanosystem.

References

[1] Feng, M. Graf, K. Liu, D. Ovchinnikov, D. Dumcenco, A. Kis, M. Heiranian, V. Nandigana, N. R. Aluru and A. Radenovic **Nature** 536, 197–200, **2016**

Figures

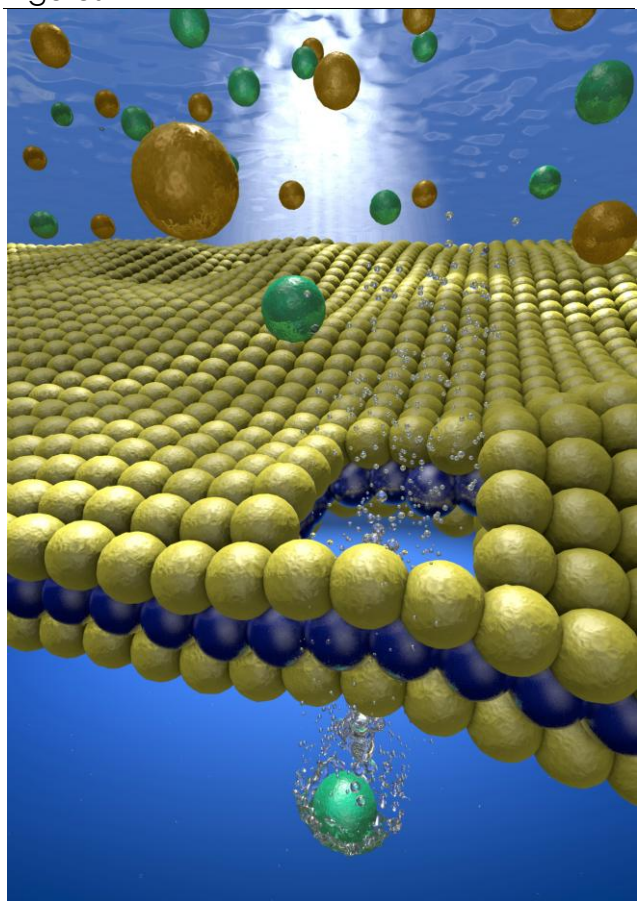

Figure 1. Image credit © Tremani / EPFL 2016