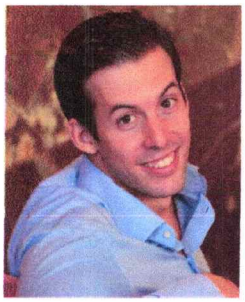
Univerza v Ljubljani
Fakulteta za strojništvo

Vljudno vabljeni na predavanje,
ki bo v petek 17.12.2021, ob 8:30 uri v Leskovarjevi sobi in preko spleta

Energy dissipation in electronics and advanced thermal management



Bio: Miguel Muñoz Rojo (https://orcid.org/0000-0001-9237-4584) received the Ph.D. degree in Condensed Matter Physics & Nanotechnology and the M.S./B.S. degree in Physics from the Autonomous University of Madrid. During this period of time, he carried out scientific stays at the Rensselaer Polytechnic Institute (New York, USA), the University of Bordeaux (France) and the University of California Berkeley (USA). Afterwards, he became a Post-Doctoral Researcher at Stanford University (Stanford, CA, USA). He received a JAE pre-doctoral Fellowship from CSIC, and attended the 62nd Lindau Nobel Laureate Meeting in Physics in 2012. From 2018 to 2021, he was a Tenure Track Assistant Professor at the University of Twente. He is now a permanent researcher at the National Research Council of Spain (CSIC) working at the institute of Micro and Nanotechnology of Madrid (IMN) within the group FINDER. He leads the area of advanced thermal management within this group. His current research focus on thermal management, energy harvesting, nano- and micro-scale thermometry and thermal sensing.

Topic: One of the greatest challenges of modern society is related to energy consumption, dissipation and waste. A prominent example is that of integrated electronics, where power dissipation issues have limited their performance. *In the first part of my talk*, I will discuss energy dissipation in electronics, like in transistors based on 2D materials or resistive random-access memory (RRAM). On the one hand, the use of 2D materials, like MoS_2, represent new opportunities for the electronic industry. However, understanding their thermal properties, like the thermal conductivity or thermal boundary resistance, is essential to achieve effective energy dissipation and avoid limited performance due to overheating. On the other hand, knowing the temperature reached by RRAM filaments is key to improve and design more efficient memory devices. However, its experimental characterization has been a long lasting challenge due to the localized heating of the filament at the nanoscale.

Additionally, the management of the heat that is dissipated by these systems for energy conversion or storage might have a major impact in modern technology. *In the second part of my talk*, I will present thermal devices that are capable to manage heat in a manner analogous to how electronic devices control electricity. I will give an example of a thermal diode that can be applied for energy storage applications.

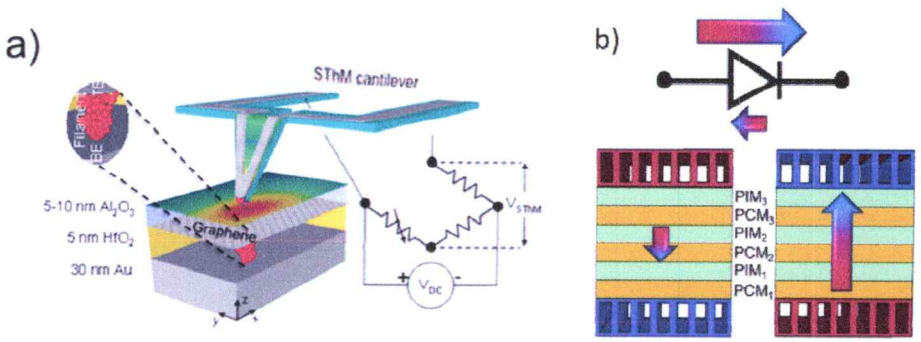


Figure 1. a) Thermal measurements of conductive filaments in RRAM memory devices. b) Thermal diode based on multilayer phase change materials (Swoboda et al., iScience, 24, 8, 102843, 2021).

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