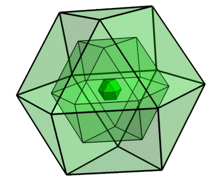
Materials Science seminars
14/7/2022 2.30 pm
Paoluzi room



Insights into flexible electronics, from organic devices to phase-change memories

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Innovative electronics is expected to be cost-effective, environmentally friendly, light-weight and unbreakable. Many efforts are targeted to the development of embedded electronics for human-machine interfaces (HMI) and for artificial intelligence (AI). Among various interesting solution currently proposed, I introduce the peculiar features of organic electronics and phase-change memories. The interest of organic materials is due to their application in flexible devices fabricated with bottom-up techniques. Besides, the unique optoelectronic properties of organic semiconductors, which can be selective to a specific wavelength or panchromatic from UV to NIR region with good photogeneration yield, make them promising candidates for light signal detection. I report on a simple flexible organic phototransistor (OPT) structure, with high stability and reproducibility for the detection of light intensities as low as few nW cm^{-2}. The OPT structure was also implemented for multiple wavelength detection in array configuration.[2] On the other hand, the big mass of data from integrated sensors necessitates in loco fast and reliable analyses, while the sustainable management of energy resources requires to perform these high demanding AI tasks with low power consumption. Among emerging technologies, the phase-change material (PCM) cell works as multilevel non-volatile memory and computational unity, overcoming Von Neumann architecture towards neuromorphic hardware. Flexible chalcogenide memories would also outdo hybrid electronics limits of integrability and sustainability, enabling the combination with photovoltaic harvesting and conformable sensors, as well as improving scalability and portability of the developed electronics. The first results we obtained in this respect are presented.[3]

[1] Organic Electronics 61 (2018) doi: 10.1016/j.orgel.2018.06.026
[2] Organic Electronics 102 (2022) doi: 10.1016/j.orgel.2022.106452
[3] Nanomaterials 12 (2022) doi: 10.3390/nano12122001