

Ciclo di incontri – Tavolo di discussione

CONVERTING VIBRATIONS AND ENVIRONMENTAL HEAT INTO ELECTRICITY VIA REVERSIBLE WATER INTRUSION INTO HYDROPHOBIC NANOPORES

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The hysteretic intrusion of a non-wetting liquid into nanoporous material can be used for a compact and efficient dissipation of high-energy impacts and vibrations. While this approach has been actively explored for applications such as car shock-absorbers, anti-seismic systems, and rocket boosters, it was just recently demonstrated that the intrusion process can also be used for electrical energy generation via triboelectrification [1-3]. In this presentation, reversible water intrusion into highly hydrophobic nanoporous Metal–Organic Frameworks and grafted silica is explored via high-pressure calorimetry, dielectric spectroscopy and in operando small-angle neutron scattering. It is shown that triboelectrification during the intrusion-extrusion process can be used to efficiently convert ambient heat and undesired vibrations into electricity. This allows a new type of regenerative energy dissipators, which among others, can be used to extend the autonomy of electric vehicles.

[1] <https://www.electro-intrusion.eu>

[2] Grosu, Y., Mierzwa, M., Eroshenko, V.A., Pawlus, S., Chorażewski, M., Nedelec, J.M. and Grolier, J.P.E., 2017. Mechanical, Thermal, and Electrical Energy Storage in a Single Working Body: Electrification and Thermal Effects upon Pressure-Induced Water Intrusion–Extrusion in Nanoporous Solids. *ACS Applied Materials & Interfaces*, 9(8), pp.7044-7049.

[3] Lowe, A., Tsyryn, N., Chorażewski, M., Zajdel, P., Mierzwa, M., Leão, J.B., Bleuel, M., Feng, T., Luo, D., Li, M., Li, D., V Stoudenets, S Pawlus, A Faik, and Y Grosu 2019. Effect of flexibility and nanotriboelectrification on the dynamic reversibility of water intrusion into nanopores: Pressure-transmitting fluid with frequency-dependent dissipation capability. *ACS Applied Materials & Interfaces*, 11(43), pp.40842-40849.



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