Poster

Exceptionally high work density of a ferroelectric dynamic organic crystal around room temperature

Durga Prasad Karothu,[1] Rodrigo Ferreira,[1] Ghada Dushaq,[2] Ejaz Ahmed,[1] Luca Catalano,[1] Jad Mahmoud Halabi,[1] Zainab Alhaddad,[1] Ibrahim Tahir,[1] Liang Li,[3] Sharmarke Mohamed,[4] Mahmoud Rasras[2] & Panče Naumov[1,5]

[1]Smart Materials Lab, New York University Abu Dhabi PO Box 129188, Abu Dhabi (United Arab Emirates)

[2] Division of Engineering, New York University Abu Dhabi, PO Box 129188 Abu Dhabi, UAE

[3]Science and Engineering Department, Sorbonne University Abu Dhabi, PO Box 38044 Abu Dhabi, UAE.

[4]Department of Chemistry, Green Chemistry & Materials Modelling Laboratory, Khalifa University of Science and Technology, PO Box 127788 Abu Dhabi, UAE

[5]Molecular Design Institute, Department of Chemistry, New York University, 100 Washington Square East, New York, NY 10003, USA

dpk3@nyu.edu

Dynamic organic crystals are rapidly gaining traction as a new class of smart materials for energy conversion, however, they are only capable of very small strokes (<12%) and most of them operate through energetically cost-prohibitive processes at high temperatures. We report on the exceptional performance of an organic actuating material with exceedingly large stroke that can reversibly convert energy into work around room temperature. When transitioning at 295–305 K on heating and at 265–275 K on cooling the ferroelectric crystals of guanidinium nitrate exert a linear stroke of 51%, the highest value observed with a reversible operation of an organic single crystal actuator. Their maximum force density is higher than electric cylinders, ceramic piezoactuators, and electrostatic actuators, and their work capacity is close to that of thermal actuators [1]. This work demonstrates the hitherto untapped potential of ionic organic crystals for applications such as light-weight capacitors, dielectrics, ferroelectric tunnel junctions, and thermistors.

[1] Karothu, D. P., Ferreira, R., Dushaq, G., Ahmed, E., Catalano, L., Halabi, H. M., Alhaddad, Z., Tahir, I., Mohamed, S., Rasras, M. & Naumov, P. (2022). *Nat. Commun*. **13**, 2823.

We thank New York University Abu Dhabi for the financial support of this work. This research was partially carried out using the Core Technology Platform resources at New York University Abu Dhabi. Z. Ah. thanks the Kawader program, NYUAD, for research and travel support.