# Conjugated polymers for thermoelectrics: a viable way to recycle waste heat?

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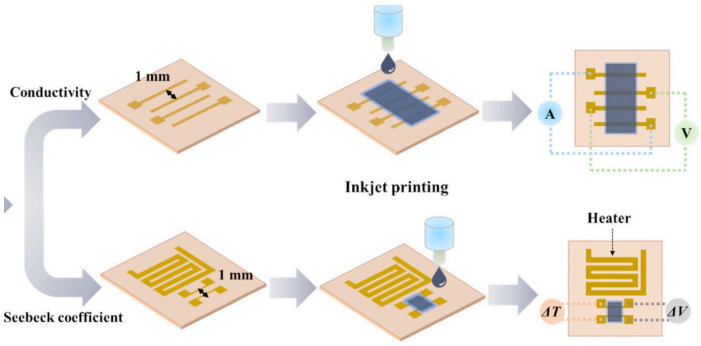
## Abstract

With world's reserves of fossil fuels being depleted rapidly, researchers are working towards the quest for new and more environmentally friendly sources of energy. Furthermore, it is estimated that >60% of the energy is lost in the form of waste heat, resulting in useless dissipation and environmental pollution. Hence, it appears clear that recycling waste heat is of utter importance, and for this reason, more and more attention is being paid to thermoelectric materials, i.e., materials that are capable of converting a heat gradient into electricity. In this presentation I will give a few examples on how to use conjugated polymers to make organic thermoelectric generators. On the one hand, I will talk about the versatility of inkjet printing technology with a commercial PEDOT:PSS ink to evaluate the thermoelectric performances of films deposited on different substrates (polyimide foils, glass, and silicon oxide) [1]. The substrate wettability and the printing direction were found to strongly impact the resulting thermoelectric performances. Moreover, to investigate the thermoelectric performances of a fully inkjet-printed flexible thermoelectric device, we compared the role of e-beam evaporated vs. inkjet-printed electrodes. In addition, I will present a novel polymer with a joint polaronic and radical conductivity which brings to a higher conductivity which is pivotal to achieving a high thermoelectric figure of merit [2, 3].




1. Jing, J., .., and E. Orgiu, "The role of substrates and electrodes in inkjet-printed PEDOT:PSS thermoelectric generators" Journ. Mater. Chem. C, Vol. 12, 6185-6192, 2024.
2. Jing, J. and E. Orgiu, "Thermoelectric properties of diketopyrrolopyrrole polymer with radical pending units" Angewandte Chemie International Edition, *in press*.
3. Eryilmaz, I. H., Chen, Y.-F., Mattana, G., and E. Orgiu "Organic thermoelectric generators: working principles, materials, and fabrication techniques" Chem. Commun., 2023, 59, 3160-31

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### Biography

Emanuele Orgiu is Full Professor at INRS, EMT Centre (Canada). Previously, he was Assistant Professor at the University of Strasbourg (France). Alongside his international team, he works on several topics such as the experimental investigation of charge, heat and magnetotransport in organic and 2D materials. His focus is based on the use of devices to gain physical understanding of novel materials. He received his PhD in 2008 from the University of Cagliari, Italy. He received numerous recognitions (Fulbright scholar, MIT35 France award, ) and he is member of the College of the Royal society of Canada and the Young Academy of Europe. He published more than 110 papers. His H-index is 35 on Scopus, and 40 on Google Scholar.

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