Organic-Composite Thermoelectrics: Balancing Performance, Sustainability and Ease of Synthesis

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For the last decade organic-composite materials have held out the promise of providing low cost, sustainable thermoelectric (TE) devices, for energy capture. Optimal materials are frequently doped multi-component blends. For example, while PEDOT-PSS can provide a power output of ~470 mW per m.K2 compositions containing additional PANI, graphene and carbon nanotubes can increase this to ~2700, above the performance of current commercial BiTe devices. Present levels of theory do not allow ab initio prediction of which blends of existing (or new) materials will provide excellent TE performance – leading to the need for new organic components/compositions to be discovered experimentally. Ideally, new organic TE materials should be prepared by sustainable chemistry using low energy routes. If not, non-deployable (due to monetary or environmental costs) easily result.

Synthetic organic/inorganic chemistry methods have been used aiming for efficient procedures. New materials have been synthesised and their TE properties measured.

Attaining sustainable organic TE materials is challenging: balancing synthetic needs against performance and sustainability, but attaining this will be vital for viable future TE technologies.

References

Selected background literature:
https://www.sciencedirect.com/science/article/pii/S2542435118305038#bib24
Selected synthesis: https://chemistry-europe.onlinelibrary.wiley.com/doi/full/10.1002/chem.201701170
Applications: https://pubs.rsc.org/en/content/articlelanding/2018/tc/c8tc00073e#!divAbstract