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Porous polythiophene dry gels for thermoelectric application

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ABSTRACT: Polythiophenes derivatives are one of the conjugated polymers that drawn a big attention due to their electrical conductivity and their excellent stability. The objective of my internship was to prepare porous aerogels and cryogels blends based on polythiophenes for thermoelectric applications. The aim was to study the effect of the porous structure on the thermal conductivity (1). The polythiophenes derivatives used were the poly(3-hexylthiophene (P3HT) and poly(2,5-bis(3-tetradecylthiophen-2-yl)-thieno(3,2-b)-thiophene) (PBTTT).

We worked on resolving the problem of the low mechanical properties and the weak cohesion of the dry gels. We looked for the right mixture and the right gel preparation and drying parameters, to get mechanically robust and handleable aerogels and cryogels. The microstructure was characterized by scanning electron microscopy, both P3HT and PBTTT showed mesoporous structure. The thermal conductivity was measured by transient plane source method. We reached 47mW/mK for P3HT:PEO blend cryogels and 46mW/mK for PBTTT aerogels. These values are 2-3 fold lower than the thermal conductivity value of P3HT foam reported in the literature. (2) The results make porous P3HT and PBTTT promising materials for organic thermoelectricity.

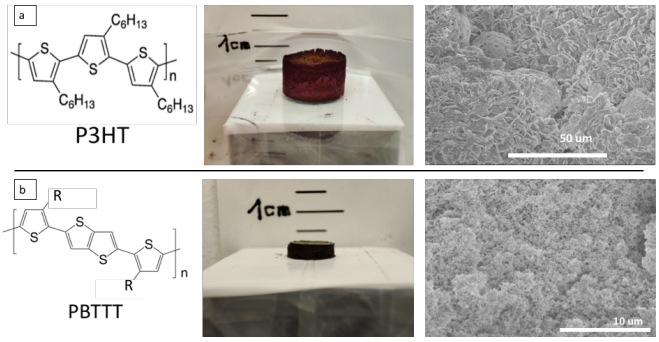

Figure: a. P3HT cryogel b. PBTTT aerogel and their SEM images.

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KEY WORDS: thermoelectricity, aerogels, cryogels, polythiophene, porous polymers, conjugated polymers.

References

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