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N-Type Thermoelectric Textile Fabrics Based on Vapor Grown Carbon Nanofibers †

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Abstract: Thermoelectric (TE) devices that convert a heat gradient directly into electricity are considered as a clean technology for energy harvesting. Both hole-transporting (p-type) and electron-transporting (n-type) materials are required in order to fabricate a thermoelectric module. Carbon nanotube (CNT)-based textile fabrics are relevant in this context for the production of wearable TE modules due to the combination of the high electrical conductivity and thermopower (Seebeck coefficient) from the CNT and the low thermal conductivity and flexibility provided by the textile fabric [1]. Nevertheless, most as-produced CNTs are p-type materials due to their inherent oxygen doping, and therefore the production of air- and thermally stable n-type CNT-based textile fabrics remains a challenge nowadays [2]. On the other hand, vapor-grown carbon nanofibers (VGCNF), produced by chemical vapor deposition (CVD), have similar structures to multiwall carbon nanotubes (MWCNT), which make them valuable for electronic applications. For instance, by adjusting process variables during their CVD and post-growth heat treatment, VGCNF can be tailored to have a wide range of thermal conductivity and electrical conductivity at room temperature. In particular, the unexpected n-type character at room temperature that they supply to dip-coated cotton fabrics will be the issue of this presentation [3].

Keywords: cotton fabrics; carbon nanofibers; negative thermoelectric power

References

1. Torah, R.; Lawrie-Ashton, J.; Li, Y.; Arumugam, S.; Sodano, H.A.; Beeby, S. Energy-harvesting materials for smart fabrics and textiles. *MRS Bull.* **2018**, *43*, 214–219.
2. Brownlie, L.; Shapter, J. Advances in carbon nanotube n-type doping: Methods, analysis and applications. *Carbon* **2018**, *126*, 257–270.
3. Paleo, A.J.; Vieira, E.M.F.; Wan, K.; Bondarchuk, O.; Cerqueira, M.F.; Goncalves, L.M.; Bilotti, E.; Alpuim, P.; Rocha, A.M. Negative thermoelectric power of melt mixed vapor grown carbon nanofiber polypropylene composites. *Carbon* **2019**, *150*, 408–416.