Low electrical resistance Graphene-Nanowires junction for piezoelectric nanogenerators

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Mechanical energy from nature and human movements can be harvested and converted into electrical current to fill our daily energy requirements. In this field, nanowires-based piezoelectric nanogenerators are interesting due to the high amount of surface they offer for the piezoelectric effect. Despite their theoretical high performance, the device level currents reported to date are still too modest, mainly due to the difficulty of scavenging the energy generated through the top and bottom electrodes. Here, we demonstrate that two dimensional materials are perfect top electrodes in vertical nanowires-based piezoelectric nanogenerators, and we fabricate a novel cell that shows unprecedented high currents at low pressures, overtaking the performance of all previous designs. The key point is the use of a graphene sheet directly transferred on the nanowires before mounting the top electrode. The two dimensional material can adapt much better to the rough morphology of the nanowires, which increases the contact area and results in a 20 times lower contact electrical resistance. Moreover, we observe spring-like effects in the graphene/nanowires network that makes the currents generated last longer times.

Keywords: Energy harvesting, piezoelectric nanogenerators, graphene, nanowires, ZnO.