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Piezoelectric nanogenerator induced work function on metal phenolic coordination framework from copper oxide nanosphere for efficient biomechanical energy harvesting and physiological monitoring

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Metal phenolic coordination frameworks (MPCFs) exhibiting relatively large surface area tend to serve as excellent fillers to stabilize electroactive beta phase of PVDF by enhancing electrical dipole moment via large interfacial polarization. Herein, we report the fabrication of a flexible piezoelectric nanogenerator (PNG) using poly (vinylidene fluoride) (PVDF) and metal phenolic coordination frameworks from copper oxide nanospheres-tannic acid (CuO-TA) nanosheets and copper-tannic acid (Cu-TA) nanocubes based nanocomposite. Both CuO-TA and Cu-TA acted as nanofillers, encouraging β-phase formation in PVDF thereby enhancing its piezoelectric property. A prominent output voltage of 40.20 V/8.90 V and an output current of 4.40 μA/3.80 μA were obtained by finger tapping the CuO-TA/Cu-TA PNG, respectively which displayed excellent repeatability and stability (< 2% decline after 3000 cycles). The enhancement of output performance is not only contributed by more β-phase formation, but also larger work function. Owing to its high sensitivity, CuO-TA PNG was employed to detect various biomechanical motions, namely, finger movements, swallowing, chewing, heel press and phonetic recognition. Besides, it was used to sense common cardiovascular parameters such as carotid and wrist pulse waveforms in real time with great precision. Overall, we believe that this work could facilitate development of personalized human diagnostic devices in future health monitoring systems.

Keywords: Metal phenolic coordination framework; piezoelectric nanogenerator; Work function; pulse monitoring.

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