Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Ferromagnetic Nanoparticle-Embedded Hybrid Nanogenerator for Harvesting Omnidirectional Vibration Energy

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1. Detailed illustration of the energy generation cycle of the TENG.

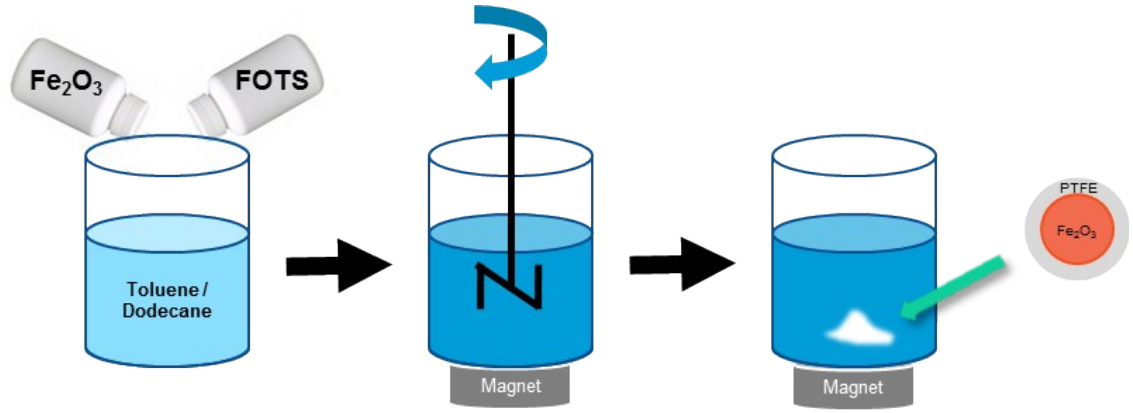

Figure S1. Detailed fabrication process of surface-functionalized Fe_2O_3.

2. Spectrum captured by X-ray Diffraction Spectroscopy (XRD).

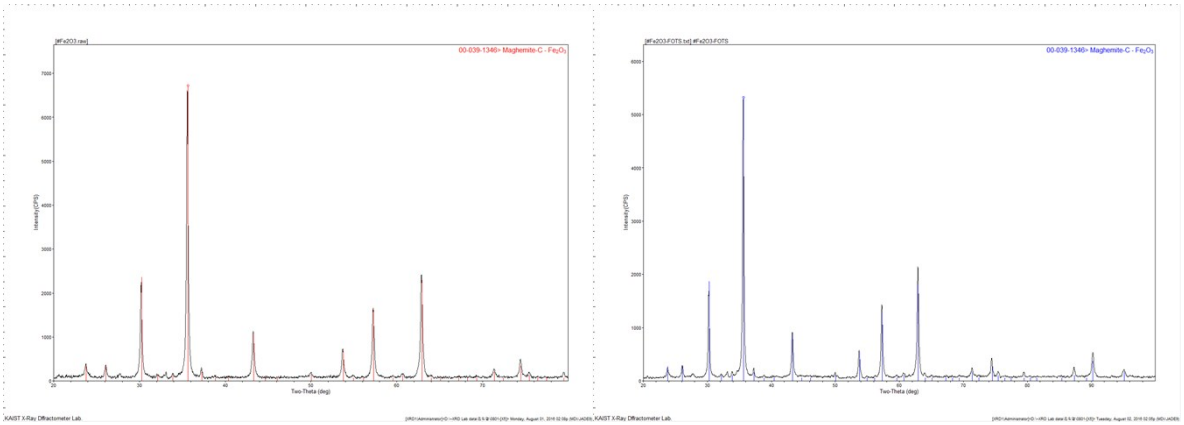

Figure S2. XRD results of pure Fe2O3 nanoparticles (left) and surface-functionalized Fe2O3 nanoparticles (right).

3. Power density of the FHNG.

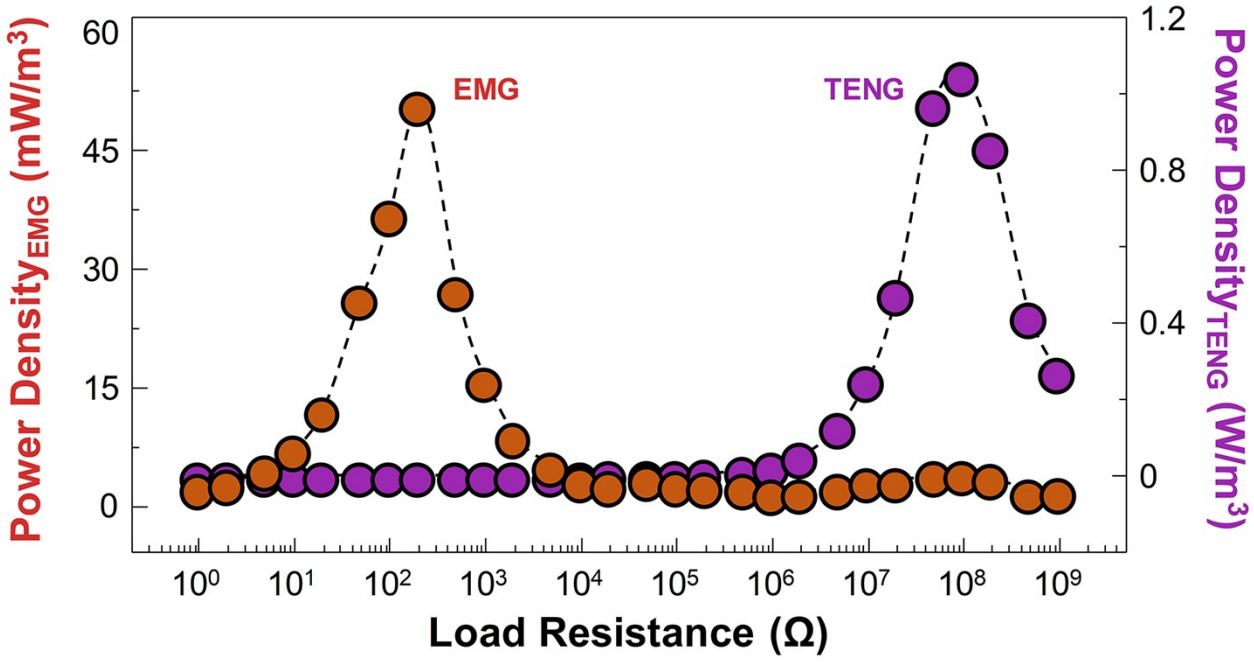

Figure S3. Power density of the FHNG when applying the vertical vibration with the frequency of 3 Hz according to the load resistance ranging from 1 Ω to 1 G Ω.

4. Output voltage of the TENG part and the EMG part of the FHNG.

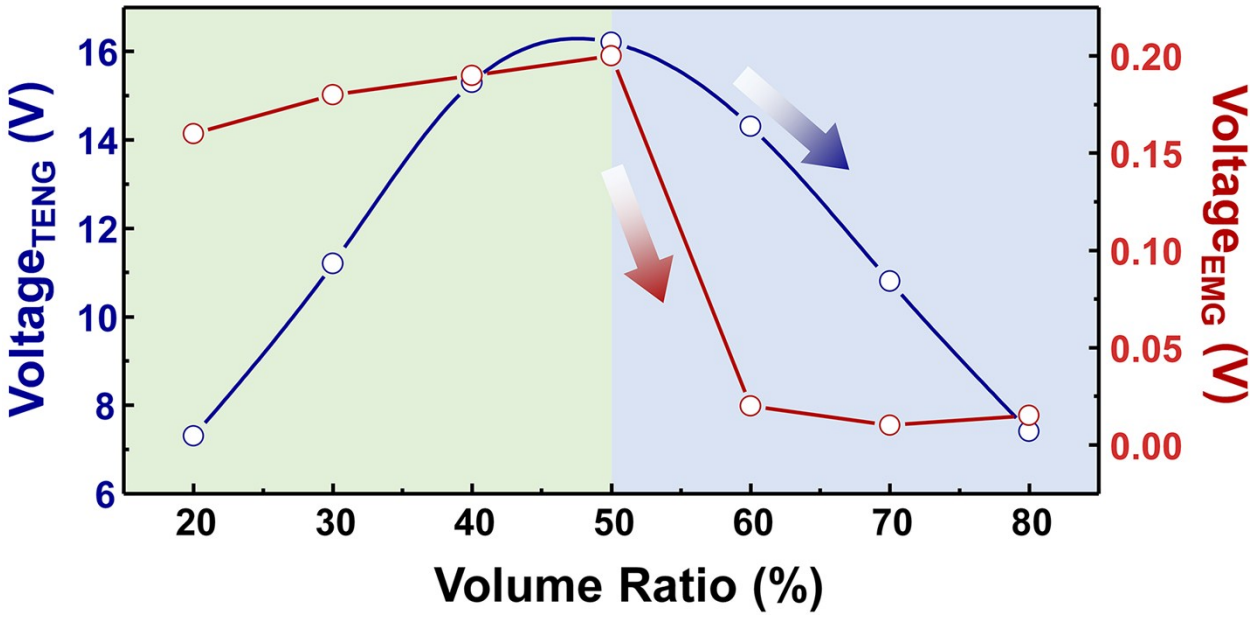

Figure S4. Output voltage of the TENG part and the EMG part generated from the FHNG according to the volume ratio of the nanoparticle (Fe_2O_3) and the device.

5. Diagram of the power management circuit (LT1302).

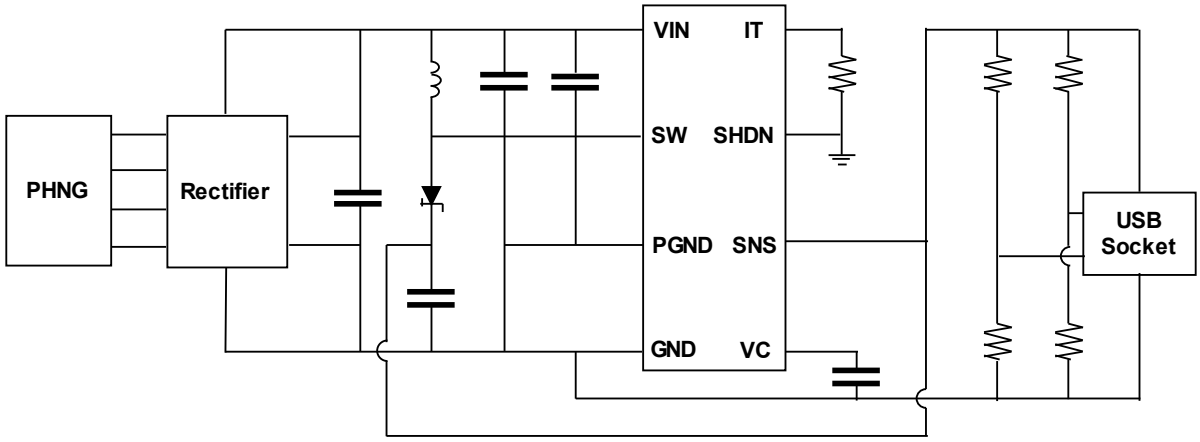

Figure S5. Power management circuit (LT1302) to operate a commercial electronic device.

6. Video for powering a G4 LED without a power management circuit

Video S1. Video for powering a G4 LED without a power management circuit.

7. Video for powering a digital clock with a power management circuit

Video S2. Video for powering a digital clock with a power management circuit.