Hybrid Energy Harvesters

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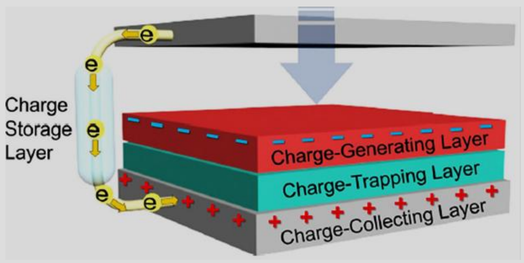
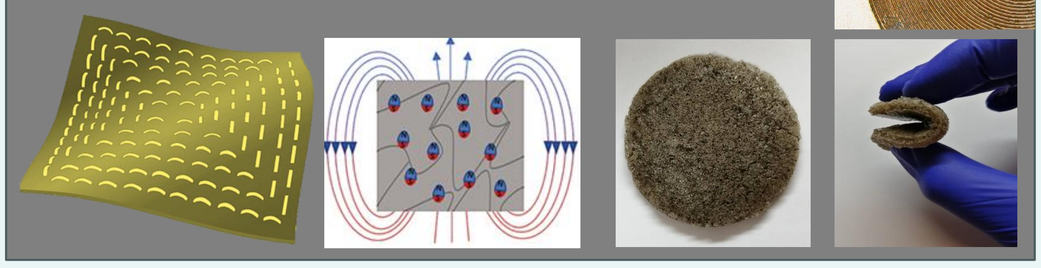
Triboelectric Nanogenerators (TENGs): Converts mechanical energy (friction, vibrations, or body motion) into electrical energy based on the triboelectric effect and electrostatic induction. Useful for harvesting energy from human motion, wind, and environmental vibrations.



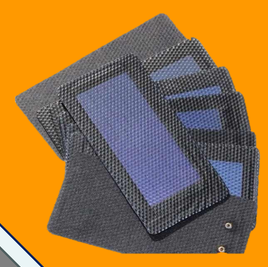
Triboelectric Nanogenerators (TENGs)

Magnetoelastic Nanogenerators (MENGs) are energy-harvesting devices that convert mechanical vibrations and deformations into electrical energy using **magnetostrictive materials**. They rely on the magnetoelastic effect, where mechanical strain induces changes in magnetic properties, which can then generate electricity via electromagnetic induction.



Photovoltaics

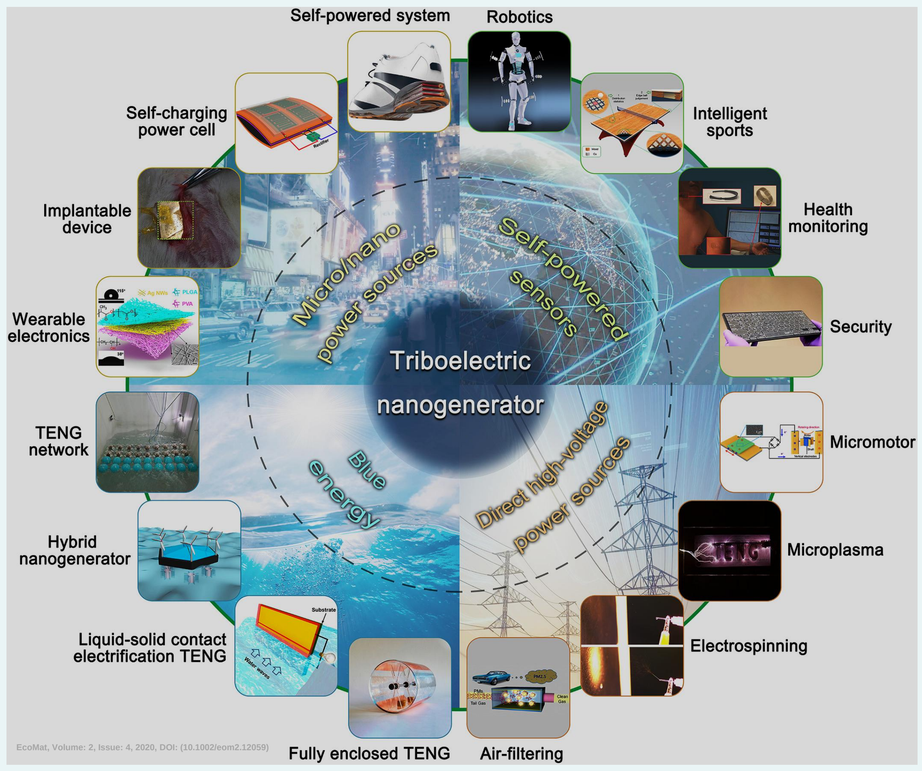
Converting light to electricity



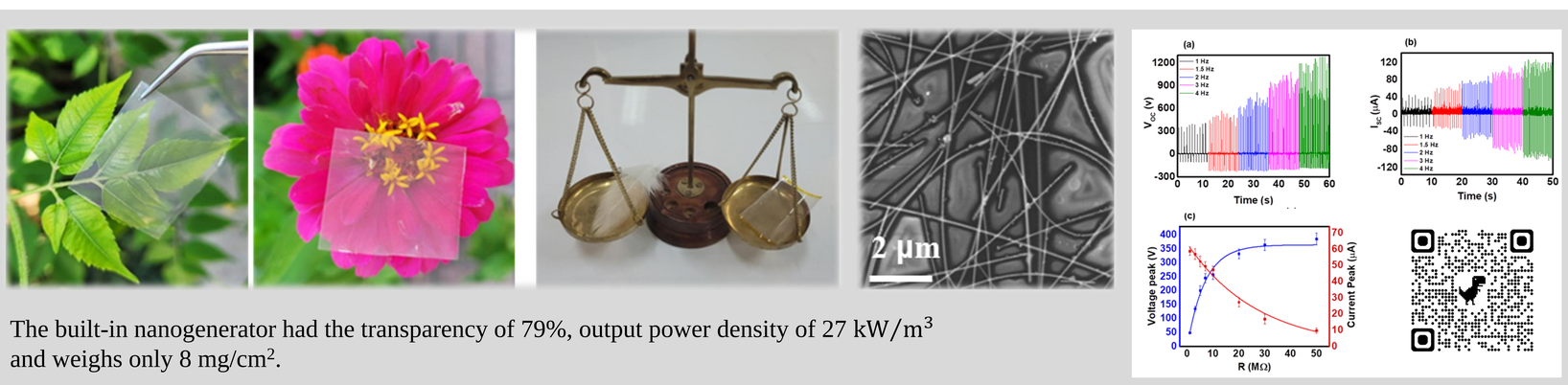
(TENG/MENG/PV) Hybridizing Energy Generators

Applications:
- **Power generators**
- **Self-powered sensors**

Key Benefits of TENGs for Power Generation
- ☑ **Works in Low-Frequency & Random Motion Environments** (e.g., human motion, ocean waves)
- ☑ **Scalable & Flexible Design** (thin-film structures for integration in different environments)
- ☑ **Eco-friendly & Sustainable** (harvests waste mechanical energy)
- ☑ **Cost-effective & Lightweight** (compared to conventional power sources)



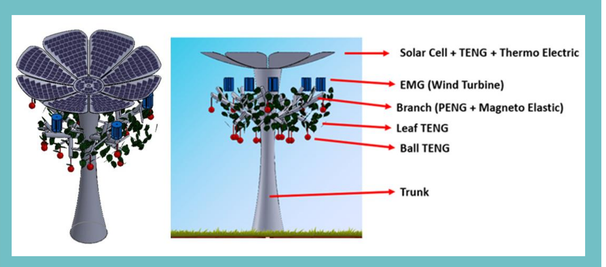
Transparent ultra light-weight TENG based on $BaTiO_3$/Ag/PDMS



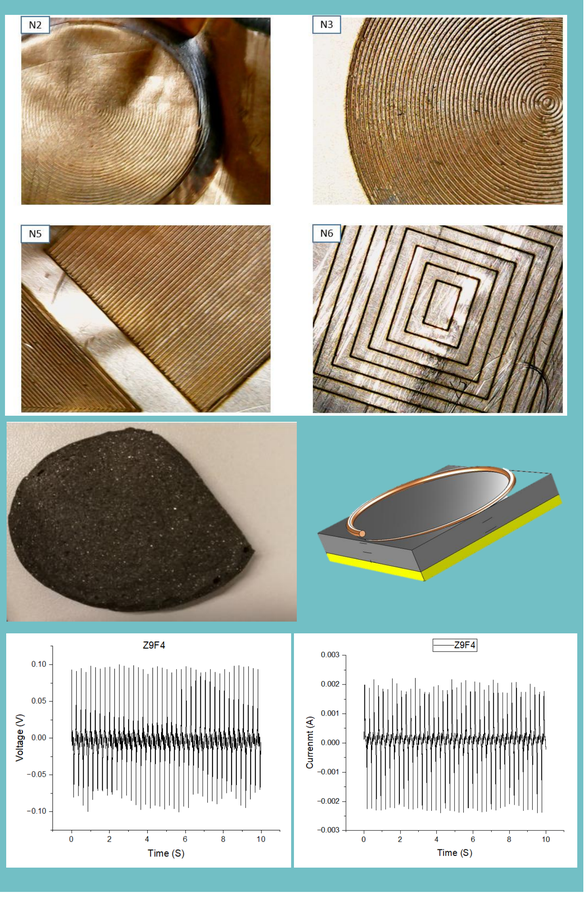
The built-in nanogenerator had the transparency of 79%, output power density of 27 kW/m^3 and weighs only 8 mg/cm^2.

Hybrid TENG/MEG/PV

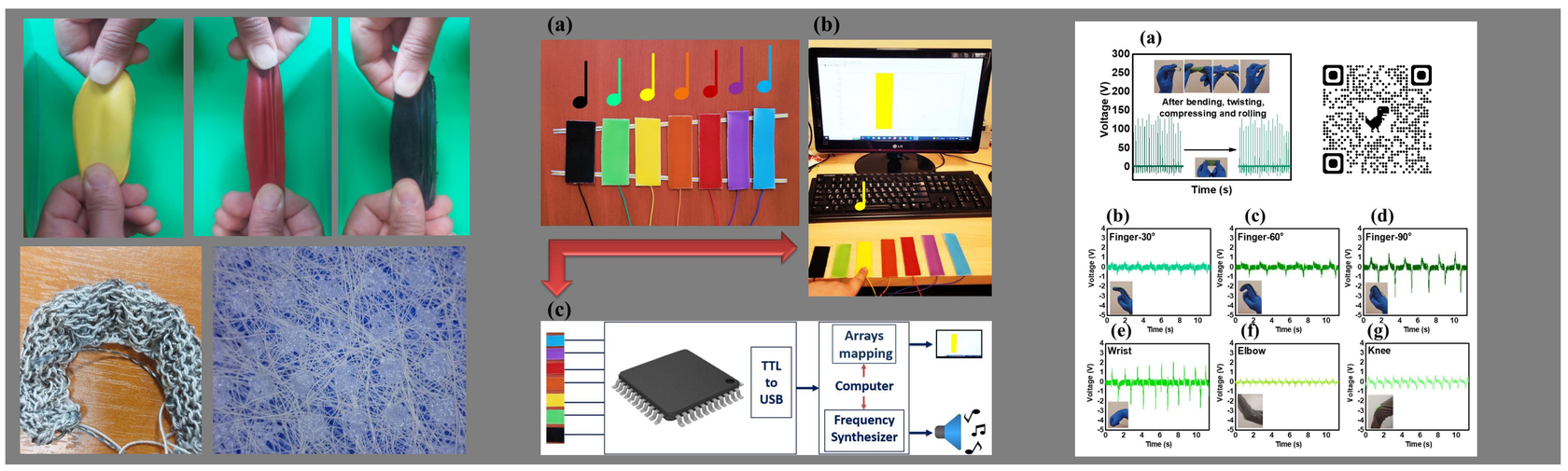
Hybrid Energy Tree



Hybrid TENG/MEG



Colorful and textile-based Triboelectric Layers: Intelligent Toys and Devices



Hybrid TENG/PV – Energy Harvesting and Personal Handwriting Recognition

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