

## **Self-Powered Sensor for Transportation Monitoring (#6084)**

*A transparent and flexible NG (TFNG) using a ZnO nanowire (NW) array on a polydimethylsiloxane (PDMS) substrate*

Georgia Tech inventors have developed a transparent and flexible NG (TFNG) using a ZnO nanowire (NW) array on a polydimethylsiloxane (PDMS) substrate. The fully packaged NG has transparency, flexibility, and robustness. It is able to harvest energy under a rolling vehicle tire with stable output. Thus, it can be used as a self-powered dynamic sensor to detect vehicle speed and weight, which can be used to monitor transportation flow.

First, the transparent and flexible PDMS substrate is prepared in the ideal thickness. Closely packed ZnO NWs are uniformly grown on the PDMS to form the core component of the 1.5 cm × 1 cm TFNG. The NWs are then coated with a polymer for insulation. Finally, transparent electrodes are deposited on the top and bottom surfaces. The transmittance of the PDMS film is over 80%, and that of the fully packaged device is 50–60% (with potential for significant improvement) in the visible range. An output power density of ~5.3 mW cm<sup>-3</sup> can be achieved, which is sufficient to power small electronic devices. No significant decay in output voltage was observed during continuous use (1 hr, ~500 cycles).

### **Benefits/Advantages**

- Self-powered sensor that does not require an external power source or specific maintenance
- Easily attached to various surfaces (i.e., it can be attached to the road without interrupting traffic)
- Can harvest energy under extended environmental conditions, especially with small perturbations, and shows excellent environmental compatibility (this is ideal for road environments)
- The entire device can be utilized for energy harvesting in various working conditions (wind, body movement, etc.)

### **Potential Commercial Applications**

- Self-powered dynamic sensor for transportation flow monitoring
- Biomedical devices
- Wind-powered sensors

### **Background/Context for This Invention**

Harvesting energy from existing sources within the environment is critical to sustainable development. Mechanical energy is one of the most abundant and reliable energy sources and is present regardless of

weather or temperature conditions. Piezoelectric nanogenerators (NGs), which convert mechanical energy into electrical energy, have enabled the development of wireless self-powered systems. Advancements in flexible electronics further expand the possible applications of NG technologies.

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**More Information**

**Publications**

For more information about this technology, please visit:

<https://licensing.research.gatech.edu/technology/self-powered-sensor-transportation-monitoring>

Images:



