

## **Sponge-Supported Triboelectric Nanogenerator For Harvesting Energy And Health Monitoring Of Railway System**

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Smart Health Monitoring based on wireless sensor network plays a crucial role in maintaining the efficiency and safety of railway systems during operation, while the power source of the railway monitoring system remains a problem. Considering the mechanical energy produced by the rail vibration a sustainable and environment friendly power source, we propose a sponge-supported triboelectric nanogenerator (S-TENG) device as an energy harvester for the railway monitoring system. A high-density sponge is utilized under the tribo-pair as an innovative flexible buffer structure. The initial gap between the tribo-pair is properly designed according to the rail vibration amplitude, to guarantee that the two dielectric materials can get into contact. While the rail with displacement beyond initial gap will compress the sponge instead of squashing the tribo-pair, so as not to break the tribo-pair and to improve the output performance by enhancing the contact force between the tribo-pair. The feasibility of the sponge base is proved through a mechanical test, and a series of well-designed experimental tests are carried out to study the output performance of S-TENG with various loading conditions. To further investigate the applicability of S-TENG in railway monitoring, we establish a theoretical model for S-TENG output performance combined with a metro train-floating slab track model, and simulate the output characteristics of S-TENG under train operation.