

Author's Accepted Manuscript

A Hybridized Electromagnetic-Triboelectric Self-Powered Sensor for Traffic Monitoring: Concept, Modelling, and Optimization

Hassan Askari, Ehsan Asadi, Zia Saadatnia, Amir Khajepour, Mir Behrad Khamesee, Jean Zu



PII: S2211-2855(16)30586-9
DOI: <http://dx.doi.org/10.1016/j.nanoen.2016.12.024>
Reference: NANOEN1675

To appear in: *Nano Energy*

Received date: 24 November 2016
Revised date: 13 December 2016
Accepted date: 13 December 2016

Cite this article as: Hassan Askari, Ehsan Asadi, Zia Saadatnia, Amir Khajepour, Mir Behrad Khamesee and Jean Zu, A Hybridized Electromagnetic-Triboelectric Self-Powered Sensor for Traffic Monitoring: Concept, Modelling, and Optimization, *Nano Energy*, <http://dx.doi.org/10.1016/j.nanoen.2016.12.024>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain

A Hybridized Electromagnetic-Triboelectric Self-Powered Sensor for Traffic Monitoring: Concept, Modelling, and Optimization

Hassan Askari^{a,*}, Ehsan Asadi^a, Zia Saadatnia^b, Amir Khajepour^a, Mir Behrad Khamesee^a, Jean Zu^b

^a*Department of Mechanical and Mechatronics Engineering, University of Waterloo, 200 University Ave. West, Waterloo, ON N2L 3G1, Canada*

^b*Nano Generators and Nano Engineering laboratory, Department of Mechanical and Industrial Engineering, University of Toronto, Toronto, ON, M5S 3G8, Canada*

Abstract

We report a hybridized electromagnetic-triboelectric generator that consists of four units of freestanding triboelectric nano generators (TENG) and four electromagnetic generators (EMG) that can be used as a self-powered sensor for road traffic monitoring. The proposed hybridized nano generator converts the periodical mechanical load over the speed bumper into electricity. We optimize the geometry of the electromagnetic component for the purpose of high power generation. With combination of TENG and EMG, it is shown that the proposed device is capable of the power and voltage generation even with very small displacements and low frequencies. Depending to the triggering frequency, TENG or EMG dominates the power generation considering different mechanical loads. The hybridized nanogenerator can deliver output volume power density of $20.96 \frac{W}{m^3}$ and $50.81 \frac{W}{m^3}$ for TENG and EMG components in frequency of $1 Hz$, respectively. The proposed nano generator not only has the potential to be implemented for sensing applications and traffic monitoring due to its high output voltage, but also is capable of power harvesting to act as a self-powered monitoring system. With the global interest toward developing smart cities, the proposed self-powered device can address the traffic monitoring challenges of those cities by providing online traffic information.

Keywords: Hybridized nano generator, Electromagnetism, Triboelectricity, Speed bumper, Traffic monitoring.

1. INTRODUCTION

Nowadays, exploiting renewable energy sources has remarkably started to receive noticeable recognition as the paramount technique for power supplying sensors and actuators. As

*Corresponding Author

Email addresses: haskari@uwaterloo.ca (Hassan Askari), easadi@uwaterloo.ca (Ehsan Asadi), zsaadat@mie.utoronto.ca (Zia Saadatnia), a.khajepour@uwaterloo.ca (Amir Khajepour), khamesee@uwaterloo.ca (Mir Behrad Khamesee), zu@mie.utoronto.ca (Jean Zu)

¹The first three authors equally contributed to the paper.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات