Cellulectricity

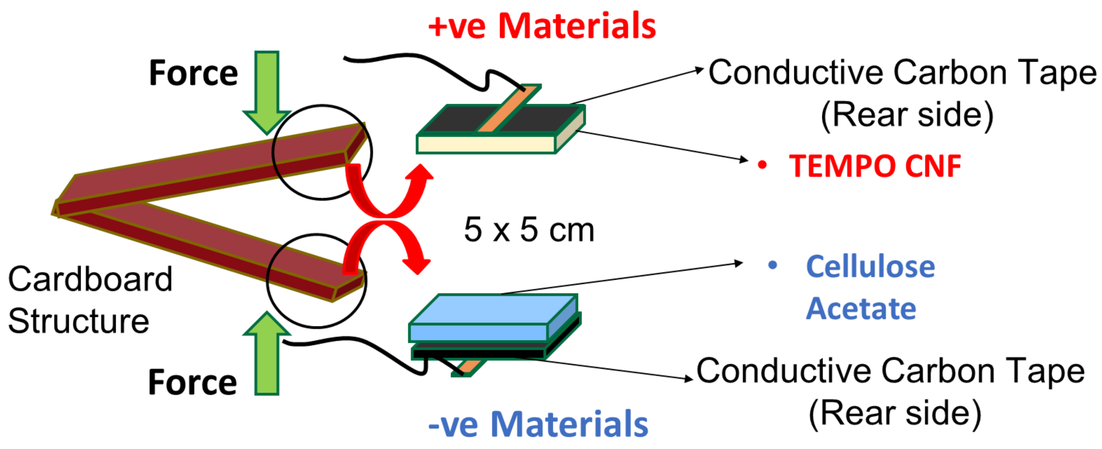
Haider Iftikhar[1], Maryam Borghei[1], Alireza Eivazi[2], Renyun Zhang[2], Christina Dahlström[2], Magnus Norgren[2], Orlando Rojas[1,3]

1. Department of Bioproducts and Biosystems, Aalto University, Aalto, Finland; 2. FSCN research center, Mid Sweden University, Sundsvall, Sweden; 3. Chemical and Biological Engineering, University of British Columbia, Vancouver, Canada

We refer to "Cellulectricity" as the generation of electrical power by actively using cellulosic materials.

Triboelectric Nanogenerators (TENG): do not require any fuel sources for energy generation[1].

TENG generate electrical energy by combining the triboelectric effect with electrostatic induction assisted by mechanical perturbations between a positive and negative triboelectric materials[2][3].

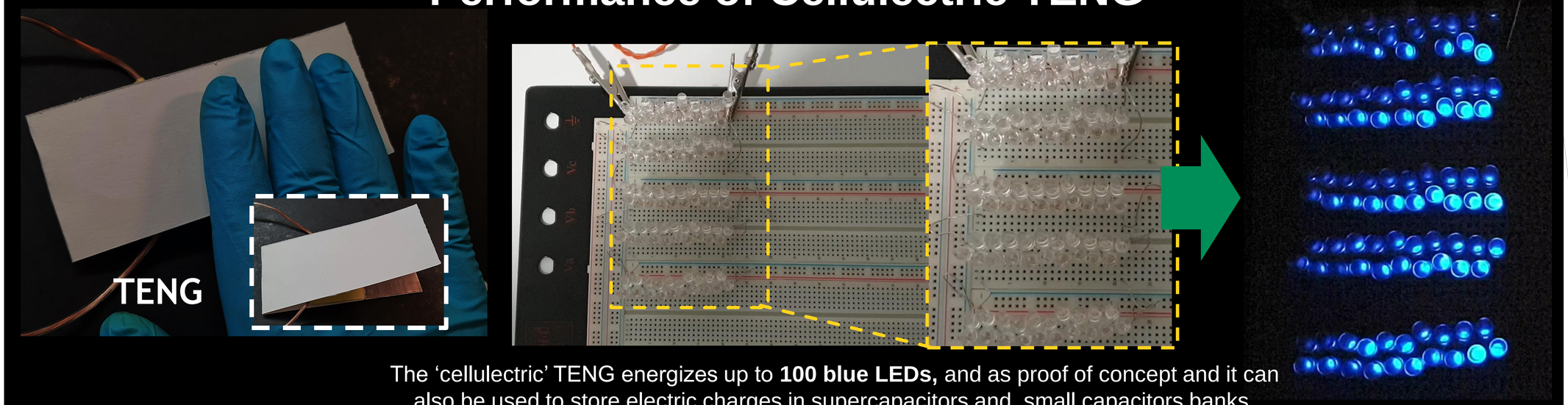


Cellulectric (cellulose-based) TENG

- Cellulose-based TENG systems were fabricated with nanopapers made of cellulose nanofibers (CNF), used as the positive material and cellulose acetate, as the negative material, forming a tribo-pair that generates electrical pulses upon cyclic mechanical contact.
- Cellulosic materials in TENG are proposed for "Green Energy Devices".

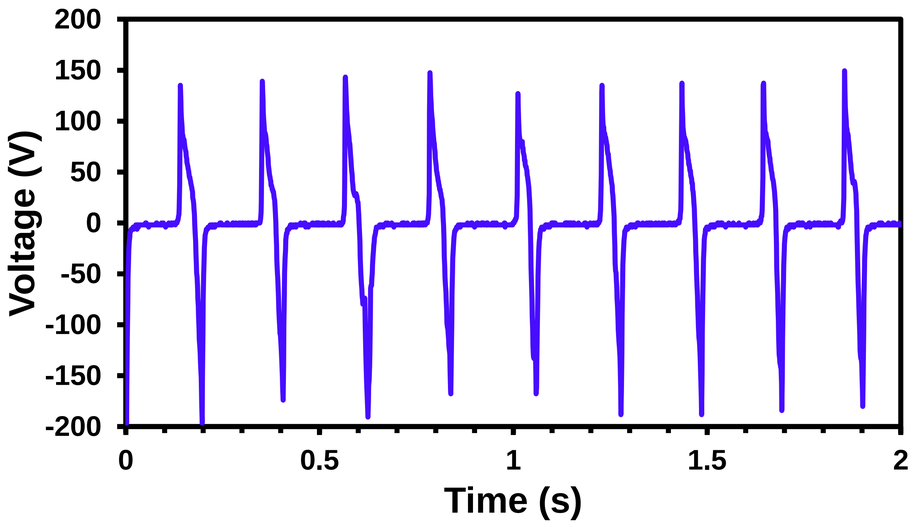
We have directly used cellulose as a biobased and renewable material for sustainable energy production with our TENG

Performance of Cellulectric TENG

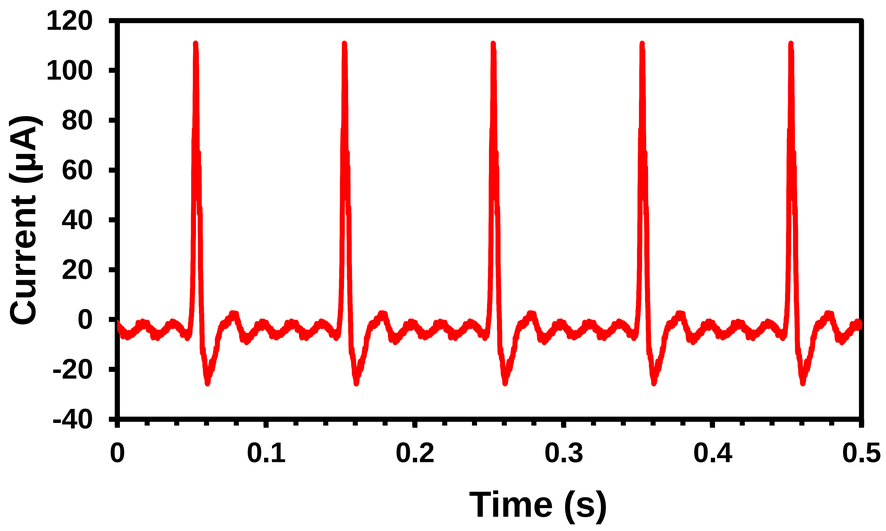


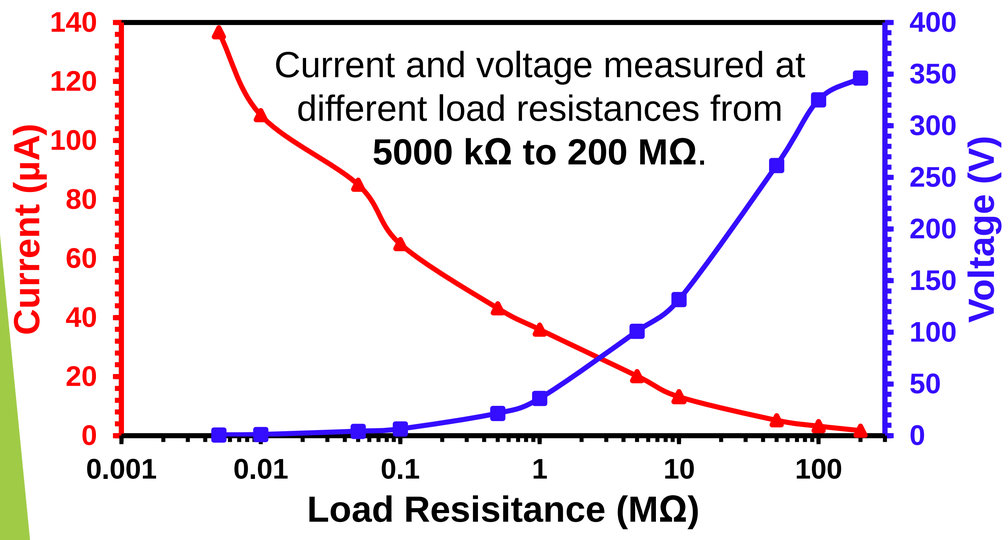
The 'cellulectric' TENG energizes up to **100 blue LEDs,** and as proof of concept and it can also be used to store electric charges in supercapacitors and small capacitors banks.

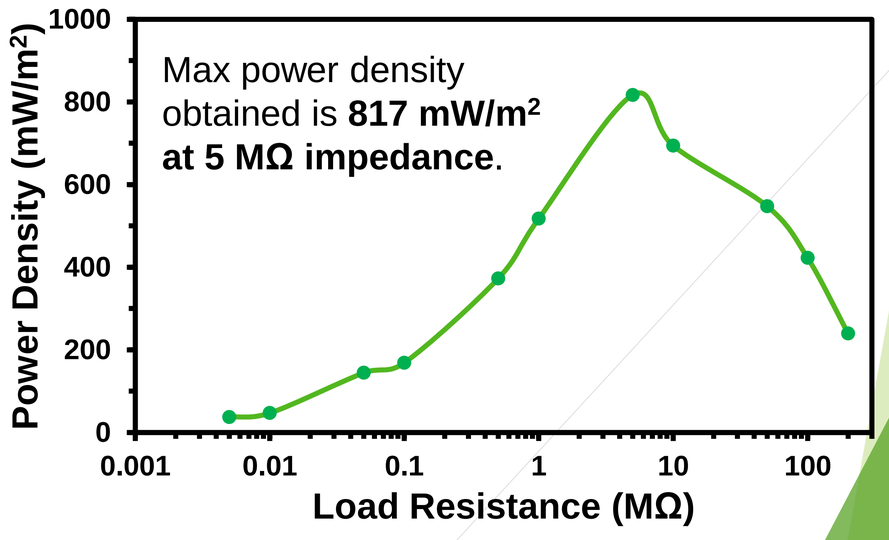
Maximum possible voltage (Open Circuit Voltage, V_{OC}) that our cellulectric TENG produce is **346 volts p-p**.



Absolute maximum current (Short Circuit Current, I_{SC}) that the cellulectric TENG generates is **137 µA p-p**.







Output power density measured at different load resistances to characterize TENG's absolute operational ability.

[1] H.-J. Kim et al., Nano Energy 2017, 33, 130; [2] Fan, F. R. at al. Nano Energy. 2012, 1 (2): 328–334; [3] Wang, Z. L.et al. ACS Nano. 2013 7 (11): 9533–9557