

## Oxidized graphene nanoribbons based triboelectric nanogenerator

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The triboelectric nanogenerator (TENG) is the device, which produces electricity through the combination of triboelectric and electrostatic induction effect [1, 2]. The effect can be explained as; when two dissimilar materials come in contact with each other, chemical bonds would be formed among them and the charges may transfer from one material to another. When these two materials are separated, the bonded atoms with large electronegativity will get extra charges while those with less electronegativity lose charges. In relation to this, we have fabricated oxidized graphene nanoribbons (GONRs) based single electrode triboelectric nanogenerator (TENG). This arch-shaped single electrode TENG would effectively convert mechanical energy into electrical energy.

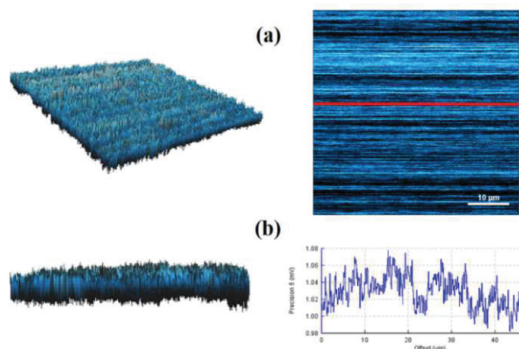


Figure 1: 3D-AFM image of the GONRs/PVDF thin film (a & b) Side view of the thin film. (c) Top view of the thin film. (d) Height profile of thin film

These GONRs were embedded in polyvinyl difluoride (PVDF) polymer matrix to form thin film. The average surface roughness as illustrated in Figure 1 by 3D - atomic force microscopy (AFM) images and charge capacity of the GONRs/PVDF thin film was increased as compare to GONRs thin film. The Fourier transform infrared (FTIR) spectroscopy was performed to study the degree of oxidation of GONRs as shown in Figure 2a. Figure 2b shows the field emission-Scanning electron microscopy (FE-SEM) image of the GONR, which confirms that the GONRs were formed from MWCNTs.

The diameter of the MWCNTs were 10-30 nm and width of GONR was found to be 65 nm, which confirms that the GONRs were formed.

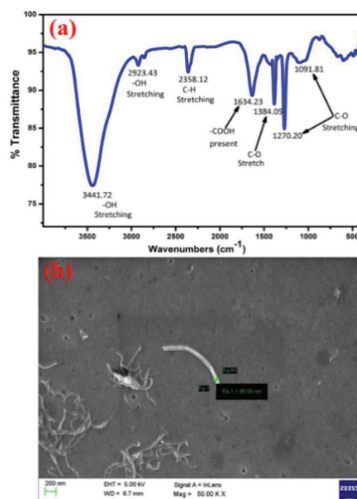


Figure 2: (a) Fourier transform infrared spectroscopy (FTIR) of the oxidised graphene nanoribbons. (b) FE-SEM image of GONR shows the width of the nanoribbons

One electrode is made up from GONRs/PVDF thin film and other was of Al foil. One electrode i.e. Al was made ground. The single electrode TENG would give output by contact separation mode, the output voltage and current was found to be 3.5 V and 97 nA, respectively. The work was further demonstrated by lighting up the light emitting diode (LED). This work may demonstrates the practicability of nanogenerator to harvest mechanical energy and opens up many new avenues of research in the energy harvesting applications.

### References

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