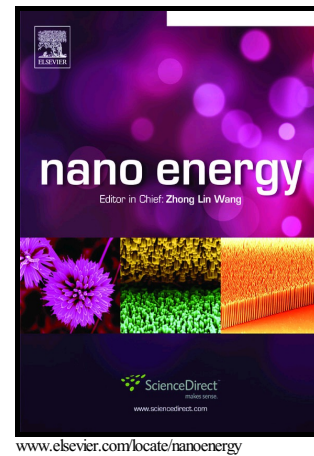


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**Highly-Sensitive and Highly-Correlative Flexible Motion Sensors based on Asymmetric Piezotronic Effect**

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**Abstract**

This paper describes two highly-sensitive flexible motion sensors (piezoelectric nanogenerators and ultraviolet light emitting diodes based flexible GaN) based on asymmetric polarization created across flexible GaN film and very high correlations of the sensors for precise motion measurement. The operation mechanism is based on piezotronic effect using polarization charges at the interface for tuning the electronic and optoelectronic processes. The nanogenerator showed very high sensitivity ( $S = 93$  at 0.45 % under concave bending) and the convex bending led to the decrease of the sensitivity to 24. The electroluminescence intensity also almost linearly decreased with the change of the bending direction, clearly shown in the confocal scanning electroluminescence microscopy images with the bending motion. The two sets of measures showed very high correlations ( $R^2 = 0.98$  and 0.96 under concave and convex bending, respectively) with very sensitive directional information. This approach makes to recognize the direction of bending as well as to measure the magnitude of the strain for realizing multi-functional, motion detection sensing devices.

Graphical abstract

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