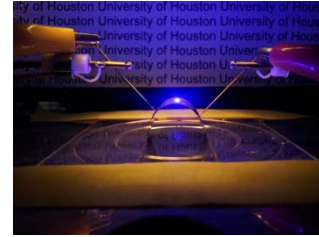


Externally-Strain-Engineered Semiconductor Photonic and Electronic Devices



Summary

An innovative method for improving the performance of flexible electronic and photonic devices, such as light-emitting diodes (LEDs) and transistors in power electronics. This method includes applying uniaxial and biaxial external bending strain to flexible III-nitride (III-N) material electronic and photonic devices. Applying external bending strain overcomes the effect of spontaneous and piezoelectric polarizations present in III-N devices. When the polarization effect is mitigated, the band tilt is minimized, and the optical performance of the device increases. Additionally, applying external bending strain alters the color of LEDs due to the changes in the effective bandgap when the device is bent in different configurations. Furthermore, external bending strain can control flexible III-N transistors used for power switching and conversion, such as high electron mobility transistors (HEMTs), by altering the density of electrons flowing through the channel of the transistor. Thus, this method is able to provide a “normal off” configuration for flexible III-N transistors.

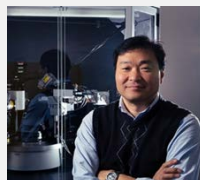
Competitive Advantages

- The efficiency of visible LEDs can be improved by over 10%
- Flexible deep-ultraviolet LEDs (DUV-LEDs) can be three times more efficient than rigid devices
- Ability to change colors emitted by a single LED
- Capable of producing white light when red, green, and blue colors are mixed under different bending conditions
- Design for III-N material transistors with a “normal off” configuration

Meet the Inventor

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Problem Addressed

- Drop in efficiency of III-N material based LEDs due to polarization and band tilt effects
- Expensive price of white light emitting and variable color LEDs
- Inconvenient and complicated fabrication process for “normal on” HEMT devices used for power switching

Applications

- Flexible LEDs
- Power electronics transistors and flexible HEMTs

Patents

- US 15/562462

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