

Piezotronics and Piezo-Phototronics

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Preface

The fundamental principles of piezotronics and piezo-phototronics were introduced by my group in 2007 and 2010, respectively. Due to the polarization of ions in a crystal that has non-central symmetry in materials such as the wurtzite structured ZnO, GaN, and InN, a piezoelectric potential (*piezopotential*) is created in the crystal by applying a stress. Owing to the simultaneous possession of piezoelectricity and semiconductor properties, the piezopotential created in the crystal has a strong effect on the carrier transport at the interface/junction. *Piezotronics* concerns the devices fabricated using the piezopotential as a “gate” voltage to tune/control charge carrier transport at a contact or junction. The *piezo-phototronic effect* is to use the piezopotential to control the carrier generation, separation, transport, and/or recombination for improving the performance of optoelectronic devices, such as photon detector, solar cell, and LED. The functionality offered by piezotronics and piezo-phototronics are complementary to CMOS technology. By an effective integration of piezotronic and piezo-phototronic devices with silicon-based CMOS technology, some unique applications can be found in areas such as human-computer interfacing, sensing and actuating in nanorobotics, smart and personalized electronic signatures, smart MEMS/NEMS, nanorobotics, and energy sciences. This book introduces the fundamentals of piezotronics and piezo-phototronics.

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Atlanta

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