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Finite Element Analysis of lateral charge distribution in ZnO nanowire JAVAD USEFIE MAFAHIM, ARKADII KROKHIN, ARUP NEOGI, University of North Texas — The coupling of piezoelectric and semiconducting properties in zinc oxide creates a strain field and charge separation across a nanowire (NW) as a result of an external or internally induced strain. The potential drop along the transverse section of a hexagonal ZnO NW is simulated by the finite element analysis method. The NW is considered to be fixed at one end and laterally deflected at the other with a uniform force on a constant area of cross-section. We numerically simulate the potential drop across a direction transverse to the growth of the NW attached to the substrate. The piezoelectric potentials difference is analyzed as a function of the lateral force, thickness, and aspect ratio of the NW. It is observed that due to a change in the component of the shear force in the transverse direction with respect to the length of the NW, a significant variation of strain in observed in the direction of the lateral force. Our analysis explains previously observed experimental results. It is also shown that the potential difference is influenced by the changing aspect ratio. The charge distribution is also analyzed in a fluid medium with a lateral flow of the liquid. Our results can be used for the design of novel biosensors.

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