WWTF Project MA09-028

Mathematics and Nano-Sensors

Abstract

The goal of this project is to do applied mathematics for nanowire gas sensors, solar cells, and ion channels. Nanowire gas sensors can measure the concentration of various gas species and have applications, for example, in fuel cell technology and biomedical technology. This project includes also aspects of fabrication and characterization of such nanowires. The mathematical models and simulations tools we will develop lead to a quantitative understanding of the underlying physics, they are crucial in making field-effect gas sensors work effectively, and they will allow to calculate what could not be calculated before. We consider charge transport in confined structures like nanowires; the resulting new transport equation and the numerical methods for their solution apply also for the simulation of solar cells and ion channels. We will also calculate electrostatic fluctuations and noise in boundary layers in nanostructures by using stochastic partial differential equations. Finally, we will simulate charge exchange between gas molecules and semiconductor surfaces by means of ab-initio calculations and reaction-kinetics equations.

Keywords:

Applied mathematics, nanotechnology, transport equations, multi-scale modeling,homogenization, stochastic PDEs, ab-initio calculations

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Further links about the involved persons and regarding the project you can find at
https://archiv.wwtf.at/programmes/mathematics/MA09-028