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Semiconductor THz antennas for sensing and energy harvesting applications

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Multicrystalline Silicon (mc-Si) has been widely used in the fabrication of solar cells due its reasonable performance and low cost that came from the high contamination by transition metals such as iron, which is presented during the module fabrication. At certain point, the high impurities will degrade the performance of solar cell by exhibiting high resistivity preventing the material to be a valid solution for this application. In this work, we will attempt to exploit the drawbacks heavily doped (contaminated) mc-Si by iron to design low-cost feasible nano-antennas for various applications. These antennas can be used in harvesting infrared energy from solar radiation or waste heat using nano-rectennas. In addition, nano-rectennas can replace batteries in low-power wearable devices by drawing energy generated from body heat, or ambient radiation. Moreover, these nano-antennas can be used in gas sensing arrays in hostile environment and extreme conditions (high temperature and radiation). When the concentration of iron goes high (i.e around 10^{20} cm^{-3}), the resistivity will be in the order of 0.001 Ω.cm will results in a conductivity of 105 S/m. This conductivity leads to a reasonable antenna resonance at THz frequencies. Several antenna configurations will be presented in this work based on the new conductivity of the heavily doped mc-Si.

Biography

Ahmed M A Sabaawi received the BSc and MSc degrees in Electronics and Communication Engineering from Mosul University, Iraq in 2002 and 2008, respectively, and PhD in Nano-electronics from Newcastle University, Newcastle Upon Tyne, UK. His research focus was on designing nanoantennas for sensing and energy harvesting applications. He is currently a Research Associate at Engineering Department, Lancaster University, UK. His current research interests include the design and optimisation of vacuum electronics for 5G mobile networks and numerical and theoretical analysis of Optical antennas.

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