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Elaboration and characterization of silicon nanostructures for photovoltaic application

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With energy being a vital global issue, research in the field of photovoltaics continues to grow. Silicon photovoltaic cells dominate the world market. One of the reasons that limit the efficiency of silicon-based solar cells are the losses due to thermalization, so new concepts based on the development of new materials consisting of nanometric layers that could eventually allow to achieve efficiencies of 25 to 30%.The objective of this work is to develop silicon nanowires by a simple and inexpensive method for improving the efficiency of silicon-based photovoltaic cells. For this purpose we have fabricated silicon nanostructures by the Metal Assisted Chemical Etching (MACE) method. The results obtained from Scanning Electron Microscopy (SEM) reveal very porous nanotexture that were observed on the silicon surface. For the manufacture of the photovoltaic cells the nanostructuring is followed by a doping with a Phosphorus Oxide (P2O5) based gel using the sol-gel thin film deposition method (spin caoting) and a thermal annealing for the diffusion of phosphorus in a very deep and homogeneous way on the whole silicon surface for good light absorption and better charge collection. The current-voltage characterization of silicon nanowire cells obtained under different etching times allowed us to determine the photovoltaic parameters. For the nanowires obtained at etch times of 30, 45 and 60 min we have respectively yields of 17.32%, 16.66% and 14.59%. For the samples that are etched under light their yields give 22.90%, 21, 33% and 25.53%.

Keywords: characterization, doping, etching, MACE, nanostructures, nanowires, photovoltaic cells, silicon, thin film .

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