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**Abstract**

The PhD thesis entitled "Growth and characterization of photovoltaic cells based on zinc oxide thin films and nanorods" describes range of applications of zinc oxide in photovoltaics. The PhD thesis contains 6 chapters. The first two chapters describe the physical rules of the operation of solar cells and of the ALD growth method.

Chapters 3,4,5 and 6 show experimental results obtained by the author. In chapter 3, the author focused on preparation of zinc oxide layers doped with aluminum atoms (AZO) for applications as a transparent conductivity oxide (TCO) in organic solar cells. Tested AZO layers showed very good electrical and optical properties comparable to these reported for ITO. Organic solar cells containing AZO films showed the overall photovoltaic efficiency of ~0.4%.

Then, the author focused on a new approach to constrict solar cells containing ZnO layers, as well as $Zn_{x-1}Mg_xO$ and AZO layers, which were grown by the atomic layer deposition method. Low costs and simple AZO/ZnO/Si solar cells showed the PV efficiency equal to 6.0%. Since, conduction band offset appearing in n-ZnO/p-Si heterojunction solar cell is recognized as a serious roadblock to obtain high efficiency solar cells, the next test cells were modified. When magnesium doped zinc oxide layers ($Zn_{x-1}Mg_xO$) were used instead of ZnO the overall PV efficiency for $Zn_{x-1}Mg_xO$/Si heterojunction increased to 10.5%.

A further improve of PV efficiency was achieved by the introduction of zinc oxide nanorods. Vertically aligned zinc oxide nanorods ($ZnO_{NR}$) were grown on bare p-type silicon substrates using a low temperature hydrothermal method. Growth of ZnO nanorods is reproducible and controllable. As-grown $ZnO_{NR}$ on Si surface were covered conformally with ZnO or $Zn_{x-1}Mg_xO$ layers. Then, AZO layer was deposited on top as a transparent conductivity oxide. The PV efficiency for such new-generation structures AZO/ZnO/$ZnO_{NR}$/Si equals to 14%.

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