

Non-vacuum Solution-processed Chalcopyrite Photovoltaics with Enhanced Performance Using
an vertically aligned ZnO Nanostructure

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To harvest incident light efficiently and transfer photo-generated charge carriers, well-aligned ZnO NR arrays with a large p-n junction area were used via a hydrothermal synthesis. A CdS buffer layer was deposited on a transparent ZnO NR substrate via room temperature solution-based synthetic route. Inorganic light absorbing materials (CIGS, CZTS) were directly coated on the prepared CdS-decorated ZnO NR substrate using molecular precursor deposition method without the need for surface passivation organics, dispersion reagent or inert atmosphere. Homogeneous molecular solution containing metal and chalcogen precursors yielded CIS nanocrystals at temperatures up to 250 °C in air environment. By comparing the optoelectronic properties and photovoltaic performances of planar and NR devices, the advantages of the application of nanostructured substrate over flat devices were demonstrated. Due to the high quality of the CdS and the efficient charge transfer, light harvesting using nanostructured ZnO window layer, improved Jsc, Voc and FF were obtained.