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황화구리 나노선을 응용한 태양전지 연구

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A study on copper sulfide solar cells using nanowires

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Key words : solar cell(태양전지), Cu_2S(황화구리), nanowire(나노선)

Abstract : We fabricated hexagonal copper sulfide (Cu_2S) nanowire known as a p-type behavior. It enables us to get a larger junction area of a diode and a shorter diffusion path of minority carriers, compared with conventional thin film solar cells. The nanowires were grown on a copper foil by a reaction with mixture gases at room temperature. The mixture gas was consisted of hydrogen sulfide and oxygen. In initial stage of the gas-solid reaction, copper oxide (Cu_2O) film was slightly formed on copper foil. It was reported that cuprite copper oxide has 2.0 eV forbidden energy gap and behaves as a p-type semiconductor. After the formation of the oxide film, copper sulfide nanowire was generated and color of the substrate was changed from specular red to fluffy black. The size, density and shape of nanowires were affected by the change of reaction time, temperature, crystallographic orientation of Cu foil, and molar ratio of the mixed gas. Crystal structure, surface morphology and compositional informations were, respectively, characterized by powder X-ray diffraction, scanning electron microscope and energy dispersive spectrometer. We controled length and diameter of the nanowires and we obtained suitable nanowire arrays which has fitting size for uniform deposition with n-type materials. CdS layer, as a n-type, was deposited uniformly on the nanowire array by electrodeposition and chemical bath deposition. The CdS layer was covered with indium tin oxide (ITO), as a transparent electrode, by RF-magnetron sputter. From I-V measurement, the Cu_2S nanowires/CdS junction showed diode characteristics and contact informations were obtained.

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