박형 태양 전지 모듈화를 위한 레이져 태빙 자동화 공정(장비) 개발

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Development on New Laser Tabbing Process for Modulation of Thin Solar Cell

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In solar cell module manufacturing, single solar cells has to be joined electrically to strings. Copper stripes coated with tin-silver-copper alloy are joined on screen printed silver of solar cells which is called busbar. The bus bar collects the electrons generated in solar cell and it is connected to the next cell in the conventional module manufacturing by a metal stringer using conventional hot air or infrared lamp soldering systems. For thin solar cells, both soldering methods have disadvantages, which heats up the whole cell to high temperatures. Because of the different thermal expansion coefficient, mechanical stresses are induced in the solar cell. Recently, the trend of solar cell is toward thinner thickness below 180um and thus the risk of breakage of solar cells is increasing. This has led to the demand for new joining processes with high productivity and reduced error rates. In our project, we have developed a new method to solder solar cells with a laser heating source. The soldering process using diode laser with wavelength of 980nm was examined. The diode laser used has a maximum power of 60W and a scanner system is used to solder dimension of 6" solar cell and the beam travel speed is optimized. For clamping copper stripe to solar cell, zirconia(ZrO)coated iron pin-spring system is used to clamp both joining parts during a scanner system is traveled. The hot plate temperature that solar cell is positioned during lasersoldering process is optimized. Also, conventional solder joints after 180℃ peel tests are compared to the laser soldering methods. Microstructures in welded zone shows that the diffusion zone between solar cell and metal stripes is better formed than inIR soldering method. It is analyzedthat the laser solder joints show no damages to the silicon wafer and no cracks beneath the contact. Peel strength between 4N and 5N are measured, with much shorter joining time than IR solder joints and it is shown that the use of laser soldering reduced the degree of bending of solar cell much less than IR soldering.

Key words : Solar Module(태양광 모듈), Laser Tabber(레이져 태버), BIPV(건물일체형태양전지)

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노즐 형상과 기판의 위치 변화가 초음속 유동에 미치는 영향에 관한 수치해석 연구

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Numerical study on the effects of nozzle geometry and substrate location in the supersonic flow

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This paper deals with the simulation of solid particle coating technology via supersonic nozzle in vacuum environment to devote as an aerosol-deposition device. In order to improve efficiencies of nozzle and coating process, effects of shockwave, nozzle geometry, and substrate location were studied computationally under a fixed chamber pressure of 0.01316 bar which is nearly vacuous. Shockwave is the important factor affect to entire flow because shockwave in the jet flow dissipates the kinetic energy of the flow in the supersonic condition. Results show that various nozzle geometries have significant effect on the supersonic flow and we know that the supersonic nozzle should be optimized to minimize the loss of the flow. Another parameter, the distance between substrate and nozzle tip, shows little effect in this study.

Key words : Supersonic flow(초음속유동), Nozzle optimization(노즐최적화), Shockwave(충격파), Vacuum environment (진공환경)

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