Spectrally Selective Photonic Structures for Photovoltaic Applications

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We present a novel concept to incorporate a photonic crystal material into PV tandem solar cells, causing two desirable effects. Firstly, the proposed structure acts as a spectrally selective filter (according to the adjustable photonic stop-gaps) between PV-cells made of materials with different electronic bandgaps. This increases the overall tandem efficiency. Secondly, the periodicity of the photonic crystal provides diffraction of light into higher orders, which results in an enlargement of the optical path inside a PV-cell. This increases absorption and allows to significantly improve the current output or for the employment of thinner cells. We present simulations based on experimental data of a silicon based PV tandem system, showing significant increase of the cells efficiency.