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EFFECT OF ANTI-REFLECTIVE COATING ON SOLAR CELLS

Abstract

Solar Energy is the primary source of energy available throughout the planet and in space. It is a reliable, cost-effective energy source. To leverage this solar energy, photovoltaic cells are used, which are devices converting the energy of light into electricity. A photovoltaic solar panel system generates electricity depending upon sunlight reaching the solar cell. Solar Cell efficiency is generally 15-20%. Most of the solar cells are made of Silicon and can be monocrystalline or polycrystalline. The fraction of reflected light from bare silicon solar cells is over 30%. As stated above, extracted power is still very low compared to incident power, hence even a few percent of reflections can have a major impact on the total extracted power. Solar flares due to solar panels systems in urban areas affect visual comfort and productivity. This can also be a safety concern on roadways and air traffic. Solar Cells have a multitude of applications in the military and defense sector, but reflections can be a significant security concern. Anti-reflective coatings are an effective solution to overcome these problems. Anti-reflection coatings on solar cells are similar to those used on other optical equipment such as camera lenses. They consist of a thin layer of dielectric material, with a specially chosen thickness. The interference effects in the coating cause the wave reflected from the anti-reflection coating top surface to be out of phase with the wave reflected from the semiconductor surfaces. This paper addresses the change in the efficiency of solar cells and the efficacy of the anti-reflective material. A sun-simulator is used to create artificial sunlight from which performances of the solar cells with coatings of various materials are analyzed. This study focuses on the performance comparison of various coating materials and their commercial feasibility. Applications of a solar panel system with anti-reflective coating can be in space or on the ground in military equipment.