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SYNTHESIS OF SILICON ON LUNAR GLASS FOR EFFICIENT PRODUCTION OF SOLAR CELLS ON THE MOON

Abstract

The future exploration of the Moon will be based on technologies that take advantage of in-situ resources, including technologies related to the power supply of mission systems and exploration equipment. This research introduces an innovative and simplified method for producing solar cells on the Moon, predominantly utilizing lunar regolith as the primary raw material while requiring minimal equipment. This approach significantly reduces reliance on Earth-based supplies and decreases implementation costs. The key advancement lies in applying the CSS (Crystalline Silicon Synthesis) process. This process entails coating a glass sheet with a thin layer of aluminum, which reacts under specific conditions of heat and pressure. The outcome is a silicon layer suitable for solar cell construction. While the CSS has been tested successfully on commercial glasses, this research proposes the use of glass plates made from lunar regolith. By melting regolith and then allowing it to cool in a suitable way, it solidifies into glass. During the CSS process, aluminum undergoes an exothermic reaction with the SiO2 present in the upper layer of the glass, yielding silicon and Al2O3. This reaction results in the formation of a crystalline silicon layer on the substrate's surface, laying the groundwork for manufacturing solar panels directly on the lunar surface. Notably, this technique offers advantages over previously reported alternative in-situ solar panel production methods. While electrolysis-based separation of metallic elements from lunar regolith incurs high energy costs, the proposed technology presents a simpler and more energy-efficient alternative, involving fewer steps. Furthermore, the raw material required for the producing lunar solar cells, i.e. raw regolith, is abundantly available on the lunar surface. The last results of the lunar glass making and the silicon synthesis on lunar glass will be presented.