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A POWER SYSTEM FOR LUNAR HUMAN PRESENCE ENABLED BY SOLAR CELL FABRICATION ON THE MOON

Abstract

The long-term potential for humans to settle space requires self-sufficiency, and therefore, self-sustaining electrical power systems. This can be attained on the Moon by utilizing the indigenous resources present there through the fabrication of thin film solar cells using the vacuum environment of the Moon. Thin film solar cells can be fabricated directly on the surface of the Moon through the deployment of a 200kg mobile cell paver with the capabilities of preparation of the lunar regolith for use as a substrate, evaporation of the appropriate semiconductor material for the solar cell structure, and deposition of metallic contacts and interconnects to form a solar array. The cell paver will be accompanied by a regolith processing facility which will extract the needed raw materials from lunar regolith so as to feed the solar cell paver as it traverses the lunar surface. This will allow for the emplacement of a lunar electric power system that can reach 1 MW in several years of paver operation at cost much lower than the launch and deployment cost of terrestrially fabricated solar cells, and pave the way for multi-megawatt to gigawatt solar power systems through the deployment of multiple cell pavers. The fabricated solar cell power systems are accompanied by novel superconducting electrical energy storage devices allowing for efficient energy availability through the lunar night. Such novel solar cell power systems fabricated from lunar resources promise not only cost effective power generation on the Moon, but the extensive power needed to support utilization and settlement of the Moon.