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Space Power Systems for Ambitious Missions (4)

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PRODUCING PYRITE BASED SOLAR PANELS FOR THE FUTURE LUNAR HABITAT

Abstract

article

It is imperative to establish reliable energy production for a sustainable presence on the Moon. The most efficient technologies for energy production should always come from in-situ resources. One such resource is pyrite (FeS2), which can be found on the Moon and could be used in solar panels to provide electrical power. Another more ambitious approach would be to construct a space-based solar power satellite (SPS) in the lunar orbit to power lunar operations. The SPS might also be transported to the geostationary orbit of Earth to provide power to terrestrial needs. Manufacturing solar panels on the Moon would reduce the amount of mass needed to be launched from Earth by 80% or more while effectively eliminating the logistical launch obstacle. Lunar manufacturing of solar panel components also reduces the environmental impact on Earth and improves cost-effectiveness.

TalTech is studying the use of pyrite in the absorber of monograin layer (MGL) solar cells. This technology enables the production of inexpensive and robust solar panels that would be easy to utilize for habitats and more extensive industrial operations. The benefit of using pyrite instead of, for example, silicon is that FeS2 can be treated at much lower temperatures, saving scarce energy resources in the early stages of lunar settlements. Pyrite also has a very high absorption coefficient, enabling the use of a much thinner layer of material. The pyrite-based MGL solar cells will be manufactured from lunar troilite (FeS) that will be mined from the surface of the Moon and extracted by electrostatic separation processes. Additional sulfur for synthesizing pyrite (FeS2) is added to troilite in the reactor to initiate the growth of pyrite microcrystals. During the solar cell assembly process, wireless energy transfer antennas will be merged into the structure. Astrostrom GmbH has been studying the feasibility of the Greater Earth Lunar Power Station - a crewed solar power satellite facility designed to provide power to operations on the lunar surface and assembled at the Earth-Moon Lagrange point 1. If shown to be both feasible and

scalable, manufacturing future solar power satellite components from lunar materials would be a means to overcome important energy issues on the Moon and on Earth as well. In the current paper, we will show the full cycle of automated fabrication of lunar solar cells as well as the assembly of the SPS satellites structures in orbit.