IAF SPACE POWER SYMPOSIUM (C3)
Space Power System for Ambitious Missions (4)

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PYRITE AS PROSPECTIVE MONOGRAIN LAYER SOLAR CELL ABSORBER MATERIAL FOR IN-SITU SOLAR CELL FABRICATION ON THE MOON

Abstract

The space race to the Moon has officially begun; vast majority of the world space agencies have set their focus to put permanent human settlement on the nearest celestial body. When NASA is starting from the Gateway project, to establish an outpost orbiting the Moon, then ESA would like to be a front-runner on the moon village concept. In order to keep the lunar outpost on the run, we will need all kinds of life support systems, starting from oxygen production, ending up with waste recycling. Regardless, the most important will be the availability of energy sources. Solar panels are one of the most promising options due to the fact that near the lunar South Pole, that is selected as a future lunar outpost location, some areas are constantly illuminated by sunlight. One option is to bring necessary solar panels from the Earth, but more practical is to find a solution to produce them in-situ from the elements and compounds available in the lunar regolith. Our research team has proposed to use mongrain layer (MGL) solar cell technology for the in-situ solar panels production on the moon. The MGL solar cell has a superstrate structure: back contact/absorber/buffer/conductive oxide layer/substrate (glass or polymer film), where the absorber is a monolayer of nearly unisize, with a typical diameter of 50 m, semiconductor powder crystals embedded into a layer of epoxy. The production of monograin layer solar cells involves simpler manufacturing steps and less material refinement steps, compared with standard silicon solar cell technology that has been proposed for in-situ solar cell production from lunar soil. We have selected pyrite FeS2 as absorber material for solar cells, because there is available a vast amount of troilite (FeS) as a suitable precursor for FeS2, in the Moon regolith. Addition of sulphur is required to form pyrite (FeS2) from troilite. Sulphur can be extracted from the troilite itself. In IAC-2020, we reported a technology developed to synthesize pyrite FeS2 microcrystals, with parameters suitable to use them in the MGL solar cell. Now we have developed a technology to deposit NiO buffer layer for p-n junction formation. The electrical and optical

properties of NiO layer will be presented and also, the parameters of the first ever pyrite monograin layer solar cell will be reported.