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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
Human Lunar Exploration (1)

Author: Mr. Byung Chul Chang
Hanyang University, Korea, Republic of, bcc@hanyang.ac.kr

Mr. Jaeho Lee
Hanyang University, Korea, Republic of, jaekojaero@hanyang.ac.kr
Prof. Tai Sik Lee
Hanyang University, Korea, Republic of, cmtsl@hanyang.ac.kr

EXPERIMENTAL STUDY ON WATERLESS LUNAR CONCRETE FOR LANDING PAD CONSTRUCTION

Abstract

Infrastructure construction on the Moon and Mars is necessary for future in-situ resource utilization (ISRU) missions. Infrastructure such as road, plants for material process and power generation, shelter, and landing pad has essential roles. One of the key infrastructures for future manned/unmanned ISRU missions is landing pad. On the future lunar outpost, there will be equipment for exploration and resource development, and these will require numerous landing of landers. Apollo astronauts already experienced rocks and dusts kicked up by the rocket engine and obscure the vision. Thus there is a need to construct landing pad on the Moon to reduce blowing debris and improve safety for astronauts and equipment already exist. Lunar concrete which is comprised of lunar regolith and binder, such as sulfur, are studied and presented as one good alternative to build infrastructures on the Moon. The studied waterless Lunar Concrete uses lunar regolith mixed with polymer binder which has advantage on using less material from Earth, sufficient strength, and possibility of heat resisting. The study considers selection of binder proper to landing pad construction such as heat resistance, impact from outer environment, deformation, and so on. Several variations will be considered and experiments will be performed to prove which mixture is proper to the landing pad construction process. However, building a landing pad on the Moon requires full automation. Therefore, construction process and structure design needs to be developed which is suitable for automated construction. One promising technology for automated construction on the Moon is layered fabrication such as 3D printing technology. It is flexible to build numerous of infrastructures and possible to be full automation. The study presents considerations for developing lunar concrete landing pad construction process for future automated construction and will introduce the possibilities that waterless lunar concrete is a proper material for automated lunar infrastructure construction and it would be one approach for lunar exploration.