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LASER-WELDED LUNAR LANDING PAD BASED ON SINTERED LUNAR REGOLITH

Abstract

Human beings are planning to return to the Moon and establish a lunar base, and the lunar landing pad is an integral part of the lunar base system, which can be used to alleviate the lunar dust problem caused by landing and launch. However, the transportation cost between the Earth and the Moon is expensive, so the concept of in-situ construction of the lunar base using abundant and easily available lunar regolith has been widely recognized. Sintering is a powder processing molding technology requiring no additional materials. Lunar regolith can be sintered into a block with excellent mechanical performance, but the block size is limited by the sintering equipment, usually only tens of centimeters. How to assemble these small-sized sintered lunar regolith modules into a building structure of several meters is one of the critical challenges faced by the in-situ construction of the lunar base. Interlocking is one of the ways to achieve module connection. Still, gaps in the interlocking structure may result in erosion caused by the lander plume interacting with the lunar soil base through the gaps.

In this paper, a method for the construction of the lunar landing pad by laser welding of sintered lunar regolith bricks is proposed. This method can realize the connection of the sintered lunar regolith modules and eliminate the gaps between the modules. Firstly, the vacuum sintering test of the HUST-1 lunar regolith simulant was carried out. Then the sintered lunar regolith module was welded with a high-power fiber laser to test the weld shear strength. Finally, a welded lunar landing pad structure with regular cube sintered lunar soil bricks was designed, and the bearing performance of the structure was calculated and analyzed using the finite element software ABAQUS. This study is expected to provide a feasible technical route for in-situ construction of lunar landing pads in the future.