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Evaluation of Lunar Regolith Geopolymer Binder as a Radioactive Shielding Material for Space Exploration Applications

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Abstract

Future manned missions to the moon will require the ability to build structures using the moon's natural resources. The geopolymer binder described in this paper (Lunamer) is a construction material that consists of up to 98% lunar regolith, drastically reducing the amount of material that must be carried from Earth in the event of lunar construction. This material could be used to fabricate structural panels and interlocking blocks that have radiation shielding and thermal insulation characteristics. These panels and blocks could be used to construct living quarters and storage facilities on the lunar surface, or as shielding panels to be installed on crafts launched from the moon surface to deep-space destinations. Lunamer specimens were manufactured in the laboratory and compressive strength results of up to 16 MPa when cast with conventional methods and 37 MPa when cast using uniaxial pressing were obtained. Simulation results have shown that the mechanical and chemical properties of Lunamer allow for adequate radiation shielding for a crew inside the lunar living quarters without additional requirements.

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