Cosmic Radiation Protection Simulation

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The aim of my research was to evaluate effective building materials for the future exploration of Mars. The greatest threat posed to humans on Mars is the high levels of ionizing radiation on the planet’s surface. For this reason, structures built on the surface of Mars will need the ability to block radiation. As transportation of a large volume of materials is not feasible, the soil on Mars, which is known as Martian regolith, must be used as the primary component. The first step of experimentation involved the preparation of two Martian regolith simulants based on the regolith analysis returned by Viking Lander 1 and Pathfinder. The ability of these regolith simulants to block radiation was tested. Both simulants were found to have a high mass attenuation coefficient. The second step of experimentation involved the making of radiation shielding bricks from regolith simulant in combination with hydrogen-rich polymers. Ten bricks were made from various blends of the Viking Lander-1 simulant and the polymers polyethylene (PE) and polyethylene oxide (PEO). The effectiveness of each at blocking gamma radiation was measured. The brick that blocked the most radiation consisted of 20% PE and 80% Viking Lander-1 regolith. Further tests were conducted on five additional bricks consisting of 20% PE and 80% Viking Lander-1 regolith. The minimum thickness needed for the gamma radiation to tend to background radiation level was 20 cm. The results of this project strongly support the feasibility of using a Martian regolith/polymer combination to protect future inhabitants of Mars.

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