Project Abstract

Identification and Development of Task Specific Deep Eutectic Solvents for the Dissolution Silica from the Lunar Regolith

This project intends to demonstrate the ability of deep-eutectic solvents (DES) to dissolve silica (SiO_2) from regolith. In space, regolith is mainly composed of silica and metal oxides. Silica can be used for the preparation of binders for cement and solar cells. Traditional approaches such as molten oxide electrolysis and terrestrial methods for the recovery of metal oxides and silica cannot be used in space because of high energy input and large volume of hazardous regents. Ionic liquids (ILs) also known as molten salts, have been used by NASA for the dissolution of regolith and recovery of metals. ILs have shown their ability to dissolve metal oxides in regolith at 150 °C; however, their ability to dissolve SiO_2 is extremely minimal. DES showed better dissolution of most of the metal oxides than traditional ILs at 60 °C but they have not been tested for the extraction of SiO_2. The main goal of the proposed project is to develop a promising DES which can readily dissolve silica in the lunar regolith. The key tasks of the proposed project include: (a) use of a molecular simulation for screening and identifying task specific DES by varying different combinations of hydrogen bond donor and acceptor and their molar ratio to dissolve silica, (b) synthesis of task specific DES and verification of their dissolution capacities for silica in the regolith, and (c) application of the synthesized DES for the extraction and recovery of silica in the regolith. It is expected that the project will lead a proprietary DES that has a capability of dissolving silica in the regolith and in natural materials at temperatures less than 100 °C.