Modeling Joule Heating Effect on Lunar O2 Generation via Electrolytic Reduction.

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Kennedy Space Center is leading research work on lunar O_2 generation via electrolytic reduction of regolith; the metal oxide present in the regolith is dissociated in oxygen anions and metal cations leading to the generation of gaseous oxygen at the anode and liquid metal at the cathode.

Electrical resistance of molten regolith is high, leading to heating of the melt when electrical current is applied between the electrodes (Joule heating). The authors have developed a 3D model using a rigorous approach for two coupled physics (thermal and electrical potential) to not only study the effect of Joule heating on temperature distribution throughout the molten regolith but also to evaluate and optimize the design of the electrolytic cell.

This paper presents the results of the thermal analysis performed on the model and used to validate the design of the electrolytic cell.

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