Gas Storage Systems for In Situ Resource Utilization. M. J. Poston[1], M. A. Miller[1], S. T. Green[1], A. B. McClenney[1], K. D. Retherford[1], and U. Raut[1], [1]Southwest Research Institute, San Antonio, TX.

A critical part of any in situ resource utilization effort is storage of volatile species harvested and separated from the regolith as refined products for future utilization in a downstream process. The most obvious option for storage is compression or liquefaction of gas in a suitable tank; however, this can carry a significant penalty in terms of energy, cryogen, structural requirements, and the safety implications associated with storage of highly pressurized or liquefied dangerous gases such as hydrogen, oxygen, and hydrogen sulfide. Use of a sorbent medium in a storage vessel can lead to conversion of a portion of stored gas to an adsorbed condensed phase having higher density than the bulk gas (i.e., the Gibbs excess), dramatically increasing the storage capacity of a vessel for a given pressure and temperature. When sorption is optimized, storage densities can even exceed those of liquefying the gas (e.g. [1]). Therefore, a sought after goal for sorbent-based storage systems is to achieve liquid densities (or higher) at lower pressures and/or higher temperatures than would be possible without the sorbent. If selected for funding, our effort will evaluate high-performing terrestrial gas storage media for use in space, as well as explore whether lunar regolith can be modified to be an operationally-useful storage medium. The key parameters are storage capacity, energetics, and kinetics for a given gas-solid combination.

Whether a carefully designed sorbent material is brought from Earth, or modified lunar regolith itself provides the sorption medium, no sorption powder can operate without supporting hardware (e.g. pressure vessel, valves, tubing) and systems (e.g. compressors, heating, chilling). Therefore, if selected for funding, we will also evaluate the systems necessary for volatiles storage and build a scaled-up laboratory ISRU storage demonstration.

References: [1] Furukawa H., Cordova, K.E, O'Keeffe, M., Yaghi, O.M. (2013) *Science, 341, 1230444*.