



## NASA STTR 2014 Phase I Solicitation

### T6.02 Metal Organic Framework Sorbents for Spacecraft Medical Applications

Lead Center: JSC

Participating Center(s): GRC

Metal Organic Frameworks (MOFs) are a new class of porous materials in which metal-to-organic ligand interactions yield structured three dimensional porosity. MOFs have several important attributes:

- They have ultrahigh porosity.
- MOFs have demonstrated thermal and chemical stability.
- They can be synthesized into a wide variety of structures with a wide range of pore sizes.
- They can be synthesized to be superhydrophobic.

Because of these attributes, MOFs show promise to improve the efficiency and effectiveness of practical gas separation systems.

To ensure human health for space exploration, NASA seeks the capability to administer therapeutic oxygen in a medical emergency. In a traditional hospital setting, medical oxygen can be delivered, and the excess oxygen is diluted and ventilated. In a confined spacecraft, administering medical oxygen by conventional means can cause ambient oxygen levels to exceed flammability limits. If oxygen could be efficiently concentrated from spacecraft cabin air, medical oxygen could be administered without increasing oxygen levels in the cabin. State of the art oxygen concentrators are too large and use too much energy to effectively operate in a spacecraft environment, in part because the oxygen separation sorbents are adversely affected by the presence of water vapor.

Much attention is being paid on using MOFs to store fuels such as hydrogen under practical conditions. This solicitation, however, is focused on exploiting the properties of MOFs to separate oxygen from cabin air. Thermal and chemical stability, selectivity in the presence of water, and selectivity under dynamic gas separation conditions are especially important. In addition to water selectivity, some operational scenarios require oxygen separation from air that contains elevated levels of CO, CO<sub>2</sub>, HCN, and HF.