Oxygen recovery via carbon dioxide electrolysis with microtubular solid oxide cells
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Research Objectives
- Investigate novel microtubular solid oxide electrolysis cells (SOECs) for oxygen recovery from direct carbon dioxide electrolysis.
- Study the fabrications of thin film electrolyte and nanostructured electrodes.
- Study redox stable oxides favoring carbon dioxide reduction reaction.
- Study electrochemical performance and stability for carbon dioxide electrolysis.
- The CO₂ electrolysis with microtubular SOECs may bring the advantages of reduced mass, volume and power while enhancing the thermal cycling durability. Carbon dioxide electrolysis with microtubular SOECs has not been reported yet. A series of issues, e.g., materials, fabrication, and test, exist toward significant advancement of microtubular SOEC performance and durability.

Approach
- Recover oxygen from carbon dioxide with microtubular solid oxide cells.
- Microtubular cells will be fabricated using micro extrusion system.
- Co-sintering approach will be employed to densify thin film electrolyte while maintaining sufficient porosity of fuel-electrode substrate.
- High performance electrodes will be fabricated by infiltrations.

Potential Impact
- The project will provide a highly efficient O₂ recovery technology from CO₂, which can fulfill future space exploration needs.
- The proposed technology will obtain sustainability and therefore “closing” the atmosphere revitalization loop for future ECLSS.
- The proposed project will bring transformative advancements of solid oxide cell technology beyond NASA applications.