Agenda

1. Introduction & Restatement of Purpose
2. Review of Proposed Roadmap Outline
3. Review of Key Opportunities Identified at Roundtable
4. New Opportunities Discussion
5. Focus Group Assembly

Space Chemistry Roundtable Recap

CME
NASA STEM
SUSTAINABILITY
August 2022

Topics: NASA exploration, In-Space manufacturing, and Commercial Space Economy
Featured speakers: Jim Green, Ferenc Darvas, Jana Stoudemire, and Kenneth Savin
Output: Identified focus area considerations, capabilities considerations, roadmap development timeline, future speakers identified and workshop report.

SCR Roundtable

SCR Webinar
NASA Exploration

Q3 – Jul-Sep	Q4 – Oct - Dec	Q1 – Jan - Mar	Q2 – Apr - Jun	Q3 – Jul-Sep
2022		2023		

SCR Webinar
Commercial Applications

SCR Quarterly

The Value of Space Chemistry

Fostering Exploration, Commercialization, and Research

The growing LEO and cis-lunar economy is set to revolutionize the space industry, making research and manufacturing in space increasingly vital. As humans venture further away from Earth, advancements in space-based research and manufacturing capabilities will be crucial to support long-term exploration missions, resource utilization, and the development of a sustainable space infrastructure.

1

Unique Environment

The microgravity environment in space offers unique conditions for experiments that cannot be replicated on Earth. This allows researchers to study chemical reactions and processes in ways that would otherwise be impossible, leading to new discoveries and insights

2

Space Exploration

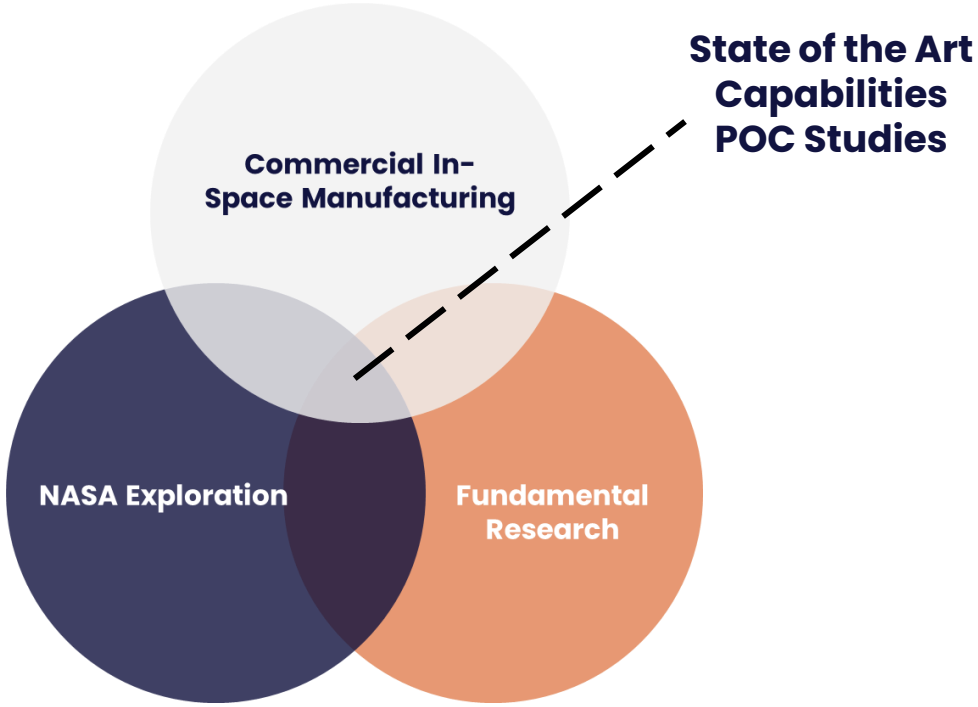
Advancements in space chemistry are critical for long-term space exploration missions, such as those to the Moon and Mars. Developing efficient and sustainable chemical processes in space can enable the production of essential resources, such as fuel, water, and oxygen, reducing the need for resupply missions from Earth.

3

In-Space Manufacturing

Space chemistry research can help develop new technologies for in-space manufacturing of advanced materials and biomedical products. These materials and products can have unique properties and applications due to the microgravity environment, potentially leading to breakthroughs in various industries.

Roadmap Objectives



To create a comprehensive, actionable space chemistry roadmap, that:

1. Identify 3-5 key focus areas where alignment between exploration, fundamental, and commercial goals exist.
2. Develop robust proof-of-concepts studies that leverage the unique opportunities and state-of-the-art capabilities offered by the International Space Station (ISS) and future commercial space stations.
3. Advance in-space manufacturing for advanced materials and biomedical products.
4. Present draft Space Chemistry Roadmap at CME NASA Symposium in August 2023 at the ACS Fall Meeting.

Proposed Roadmap Outline

Note: Page numbers and number of pages per section are placeholders.

Key Opportunities Identified

Proposed Focus Areas

1. **Crystals**
   Protein Crystals, Semiconductor
2. **Thin Films**
   Polymer Films,
3. **Flow Chemistry**
   Pharmaceuticals
4. **Nanomaterials**
   CNT's, Graphene, Nanoparticles

Polymers, MOFs, Ring opening/closing reactions, Quantum Chemistry, Optical Fiber, CO_2 conversion

Capability Considerations

1. **Remote Control & Data Management**
   Remote control of on-orbit operations
   Near-real time data downlink
2. **Reactors & Analytical Methods**
   Modular systems and reactors
   On-orbit characterization techniques
3. **Automation and Delivery Systems**
   Universal delivery systems incorporating robotics and automation
   Transition from analog to digitized chemistry
4. **Reagents and Feedstock**
   Transport of reagents to ISS vs. on-board
   Pluripotent materials as starting feedstocks for multiple products