2019 ISSRDC MATERIALS SCIENCE IN SPACE WORKSHOP

ISSR&D CONFERENCE 2019

Michael Roberts, ISS National Laboratory Deputy Chief Scientist

Materials Science In Space Workshop: Common Objectives

- This workshop focuses on the identification of future materials science investigations that enable the exploration goals of NASA and the research, technology development, and LEO industrialization goals of the ISS National Lab.

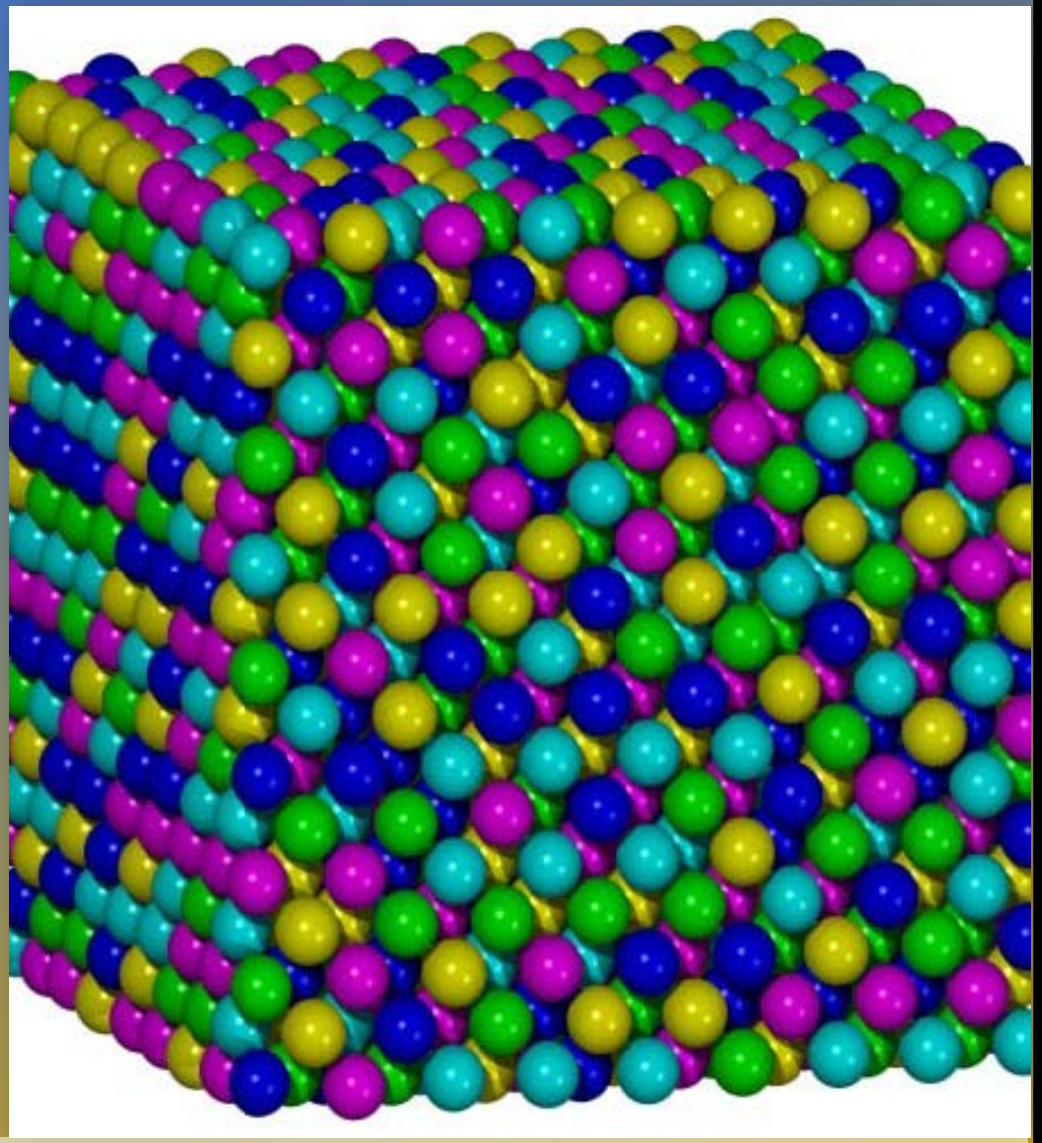
- Primary focus sessions today are:
  - *Functional Materials*
  - *Materials Characterization, Microstructure and Process Modeling*
  - *Lunar Infrastructure and Surface Operations*
  - *Crosscutting through all three of these sessions are advanced manufacturing techniques (including additive manufacturing), thermophysical properties measurements, and computational materials science enabled by machine learning and artificial intelligence.*

Materials Science In Space Workshop: ISSNL Objectives

- Enable US based investigators to develop and test novel materials in the microgravity environment to:
  - *Design and test novel materials to observe material behavior in a unique physical realm*
  - *Test materials and novel applications in the space environment to understand failure modes and define failure mechanisms in accelerated models*

Materials Science In Space Workshop: ISSNL Objectives

- Enable US based institutions to develop and test novel materials in the microgravity environment to:
  - *Improve earth based, industrial processing*
  - *Identify promising new pathways and technologies*
  - *Create demand for manufacturing and industrialization in LEO*



High-Entropy Alloys

Several elements of roughly equal proportion

Small-scale HEA (*eg* NbTaMoW) exhibit yield strengths 4-10 Gpa

Microgravity can facilitate mixing of different-density constituents

•CoCrFeMnNi HEA

- Wang, Entropy 2013

Metallic Glasses

Amorphous rather than crystalline structure resulting in high strength and wear resistance.

Containerless processing important in reducing contamination (microgravity opportunity)

AI (Artificial Intelligence) used in predicting and evaluating 20,000 likely metallic glass compositions (there are millions of possibilities.

Metamaterials microlattice

99.99% Air

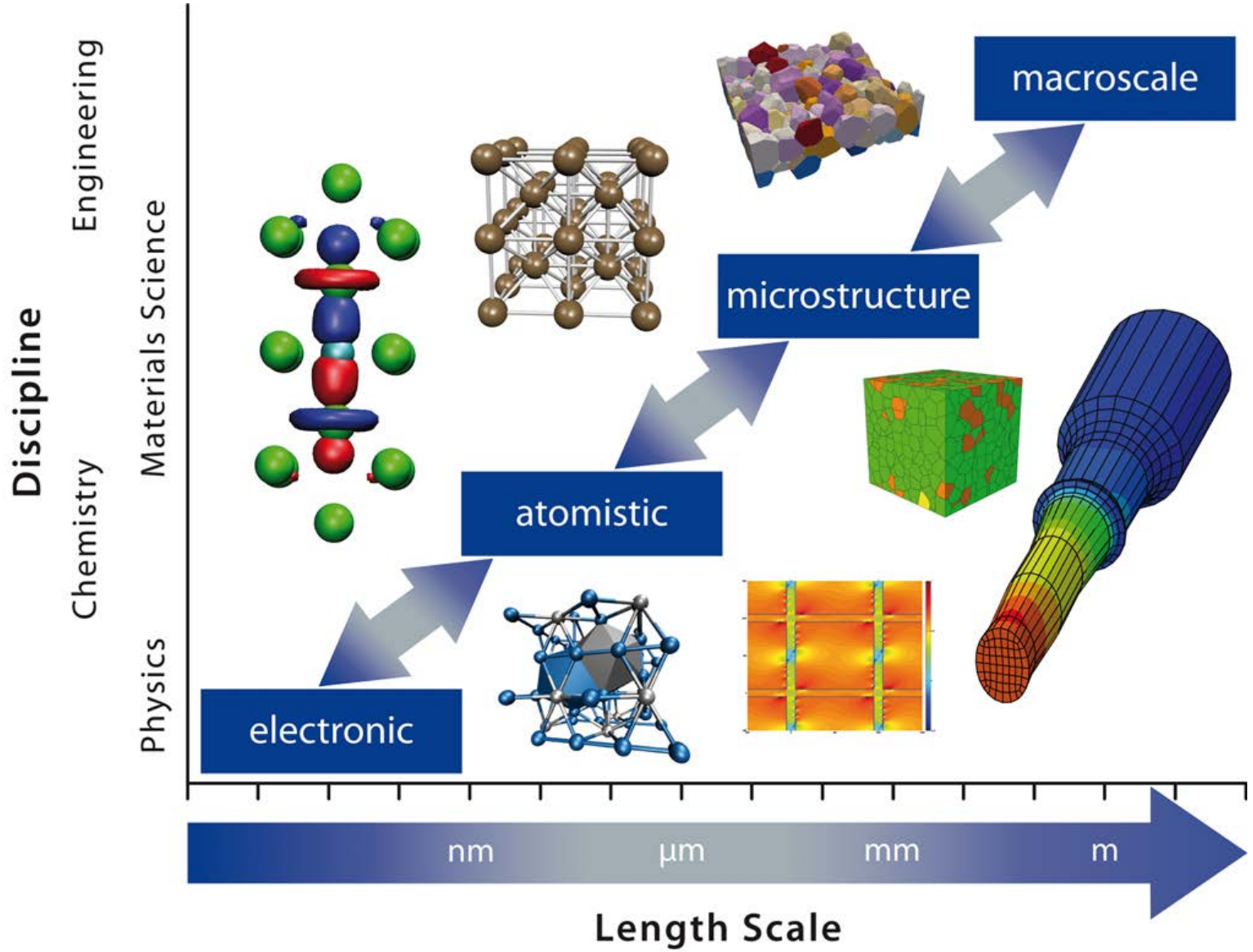
Ultra-ultralight materials.

Microgravity can facilitate 3D printing of extremely low density materials.

- HRL Laboratories, LLC

MATERIALS RESEARCH IN SPACE

Opportunities for R&D and industrialization in low earth orbit



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