

Contribution to "AIAA Aerospace Year in Review" article

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The NASA Marshall Space Flight Center Microgravity Science Program is dedicated to promoting our understanding of materials processing by conducting relevant experiments in the microgravity environment and supporting related modeling efforts with the intent of improving ground-based practices. Currently funded investigations include research on dopant distribution and defect formation in semiconductors, microstructural development and transitions in dendritic casting alloys, coarsening phenomena, competition between thermal and kinetic phase formation, and the formation of glassy vs. crystalline material.

NASA Microgravity Materials Science Principle Investigators are selected for funding either through a proposal in response to a NASA Research Announcement or by collaborating on a team that has successfully proposed to a foreign space agency research announcement. In the latter case, a US investigator can then apply to NASA for funding through an unsolicited proposal. The International Space Station (ISS) facilities used for the experimental investigations are provided primarily by partnering with foreign agencies and often US investigators are working as a part of a larger team studying a specific area of materials science.

Facilities for conducting experiments aboard the ISS include the European Space Agency (ESA) Low Gradient Facility (LGF) and the Solidification and Quench (SQF) modular inserts to the Materials Research Rack/Materials Science Laboratory and are primarily used for controlled solidification studies. The French Space Agency (CNES) provided DECLIC facility allows direct observation of morphological development in transparent materials that solidify analogously to metals. The ESA provided Electro-Magnetic Levitator (EML) is designed to levitate, melt and then cool samples in order to determine material properties, study nucleation behavior, and document phase transitions. Finally, the Microgravity Science Glovebox (MSG) serves as a on-board facility for supporting the hardware required to conduct a number of smaller, short-term investigations.