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Microgravity Sciences on board ISS and beyond (6)

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MATERIAL SCIENCE LAB OPERATIONS ONBOARD THE INTERNATIONAL SPACE STATION

Abstract

The Materials Science Laboratory (MSL) onboard the International Space Station (ISS) is designed for the research of various solidification processes under microgravity conditions – ranging from directional solidification over sintering processes to growth of semiconductor crystals from vapor deposition. It is equipped with two exchangeable furnace inserts of Bridgman-type allowing processing temperatures of up to 1400 C with various temperature gradients. MSL is operated under ESA contract by the Microgravity User Support Center (MUSC) at DLR in Cologne in collaboration with Marshall Space Flight Center (MSFC) at Huntsville, Alabama USA, which is responsible for the Materials Science Research Rack (MSRR-1) that hosts MSL. MSL, launched in 2009 and installed in the US Destiny laboratory module, performed in the course of 13 years in operation more than 48 experiments by different international project teams, with research still ongoing. With the deployment of NASA's unique multi-purpose cartridge - first utilized for investigations of sintering processes within MSL between 2019/2020, ESA and NASA, will utilize MSL for future investigations. This paper will give an overview on the new challenges MSL science operations will face in these future activities, ranging from directional solidification to semiconductor growth from vapor deposition, with different requirements. Keywords: (MSL, MSRR, ISS, solidification, materials science)