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THE ELECTROMAGNETIC LEVITATOR (EML) ON-BOARD THE ISS: CAPABILITIES, ON-ORBIT
PERFORMANCE AND RECENT ENHANCEMENTS.

Abstract

Electromagnetic levitation (EML) under microgravity provides unique opportunities for the investigation of liquid metals, alloys and semiconductors, both above and below their melting temperatures, in particular also including the undercooled regime. Besides fundamental scientific interests the research supported by EML is also oriented to industrial applications where reliable data for accurate modelling of industrial processes are difficult or impossible to be obtained on ground. The EML payload has been developed by Airbus Defense & Space under contracts to ESA and DLR. Following its launch with ATV-5, EML has been installed and commissioned on the ISS in 2014, and almost 2 complete batches of experiments have been conducted since, processing 36 samples with a total of more than 1500 individual melt cycles. This paper provides an overview of the capabilities of the EML payload which comprise precision measurements of various physical properties over a broad temperature range as e.g. viscosity, surface tension, heat capacity, heat of fusion, hemispherical emissivity, and electrical conductivity as well as studies of solidification statistics, crystal growth speed, morphology and phase selection. Performance data obtained from on-orbit experiments and recent facility enhancements are presented. Moreover an outlook to near-term EML program activities and further future enhancements is given increasing the facility's capabilities for the coming years and sound scientific experiment batches.