Contribution ID: **368** Type: **Oral Presentation**

Thermophysical property measurement of selected Nickel based superalloys by voestalpine BÖHLER Edelstahl GmbH & Co KG using a gas-tight Furnace Rheometer System and an Electromagnetic Levitation Apparatus

Thursday 9 October 2025 13:20 (20 minutes)

Thermophysical property data of liquid alloys, like viscosity and surface tension, are key input parameters in numerical fluid simulations. For production processes with extreme conditions and under harsh environments, like in steel industry, these simulations are a promising option to gain a deeper insight into those processes that are difficult (or even impossible) to study by measurement techniques otherwise. Therefore, thermophysical property measurements are performed in research and development at voestalpine BÖHLER Edelstahl to enable such simulations and consequently allow to optimize the processes itself (e.g. the gas atomization for AM powders) or to improve the properties of the products from these processes. A commercial high-temperature furnace rheometer system (FRS) by Anton Paar is used to measure viscosity while surface tension and density are obtained using a terrestrial electromagnetic levitation (EML) setup.

For this talk, a selection of common Nickel based superalloys by voestalpine BÖHLER Edelstahl is studied using the FRS and EML and results for the different alloys are compared to each other. As required for aerospace applications, these alloys follow clear and detailed specifications and the obtained data is therefore not only valuable for model validation in basic research but also for future material comparisons. The availability of the data is also beneficial for simulations where BÖHLER alloys are used in a subsequent manufacturing process, e.g. selective laser melting of AM powders (BÖHLER AMPO).

Recent FRS measurement results on Nickel based superalloys showed unexpectedly large viscosity values that are presumably caused by strong oxidation of the sample material. It was therefore decided to upgrade the FRS with the so-called "gas-tight"option that promises oxygen-free measurements of the melt. Hence, it is planned to put an emphasis on the comparison of the measurement results obtained before and after the upgrade.

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Session Classification: Additive Manufacturing

Track Classification: Additive manufacturing