# A Computational Study on Thermal Conductivity Measurements of High Temperature Liquid Materials

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## Abstract

Accurate thermo-physical properties of materials are valuable for both scientific research and industrial applications. At low temperatures, thermal conductivity is usually measured by creating a unidirectional heat transfer scenario and applying Fourier's Law. For high temperature liquid materials, two issues exclude traditional methods: elevated reactivity of test material and experimental apparatus, uncontrolled heat transfer through radiation and convection.

Electromagetic Levitation (EML) provides a means for processing high temperature materials without contact. Incorporating this technique, Rainer Wunderlich and Hans Fecht, from Unversity of Ulm, devised and developed EML based Modulated Calorimetry (EML-MC). This method has been proved effective for thermal conductivity measurements of high temperature solids.

In this study, the utility of this technique for high temperature liquid materials are explored using COMSOL Multiphysics® software. The accuracy of current thermal conductivity measuring scheme is determined under different levels of convective interference. The governing principle of the dependence of measurement error is revealed. Recommendations are provided for accurate thermal conductivity measurement of a Zr-based multicomponent alloy at high temperature liquid state.