# Level and surface structure measurements on liquid metals

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The detection of the height means from the physical point of view only the simple determination of a distance vector. The reliable and precise knowledge of the fluid level, which can be understood as the absolute value of the distance vector, in a reaction chamber, however, is an essential pre-requisite in energy and process plants not only to ensure an efficient continuous process but also to enable safe operation. When liquid metals are used a number of special challenges are posed to the metrology, which preclude a set of commercially available measurement systems. This scopes amongst many others mainly increased process temperatures, the material compatibility of the sensors with the liquid metal as well as its specular surface. All these aspects demand specific technological solutions. Some liquid metal applications may require for functional or other purposes a time-resolved detection of the surface structure of the liquid metal with a high accuracy, which further limits the complexity of the measurement method to be selected.

First, the requirements for measurement procedures in liquid metal systems are formulated and discussed in terms of operation and performance. Following this, starting from simple level measuring systems already used in practice, which are based on mechanical (pressure buoyancy) or electrostatic principles (resistance, capacitance), wave processes in particular are addressed.

Longitudinal and the entire spectrum, especially electromagnetic waves (light or High frequency -HF) offer in principle the capability to measure level and surface shape by the use of direct approaches as time difference measurements (Ultra-Sound Transition Time-UTT or Time of Flight-ToF) or indirect approaches based phase shift. Regarding those the measurement principles are elaborated and discussed by examples. Electromagnetic waves as HF radar or laser methods allow by interference or stereo techniques to acquire with high resolution entire surfaces, but pose also significant effort to signal processing, calibration to attain the desired accuracy and/or temporal resolution. The current state of the art and some examples are presented and perspectives are illustrated.