

Liquid metals and their containers: Interfaces, interactions and synergy between theory and experiments

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Abstract

Liquid metals and their interfaces play a crucial role in many current technological processes (soldering, brazing, crystal growing, alloying, metals purification, composites fabrication, etc.), mostly at high temperatures. In all these processes, surface tension is the thermodynamic quantity which plays the role of key parameter, whose value can often determine whether the process is feasible or not. Such an important role demands a full knowledge of surface tension values as function of temperature, composition, etc. Surface tension measurements of pure liquid substances are still challenging due to the high extremely sensitive to the degree of surface cleanliness so they must be carried out under rigorously controlled conditions. Indeed, the main reason for the scatter, frequently found in the results from different sources, may be ascribed to surface pollution by undesired chemical species. Such discrepancies still make “debated” the surface value of several pure elements which are fundamental for the current demanding applications, such as liquid Al, Si, etc.

Since 1970, surface properties of liquid metals and their related interactions with dissimilar materials are extensively studied at CNR-ICMATE Institute.

Over the years, the scientists involved in studying liquid metals at high temperatures, spent time and made efforts to develop and transfer to the younger reserchers, the successful mindset to conduct their research activity. It is based on a synergy between experiments and modeling. Such an approach is extremely helpful due to the increased demands in designing “ad-hoc” metallic based materials with increased capabilities, mainly under extreme conditions.

Surface properties and surface tension measurements will be selected as an example for giving an idea on how “combined method” works. Finally, in order to put into practice another lesson lerned from our predecessors about the huge value of collaborations, the research activities ongoing at CNR-ICMATE and focused on liquid metals “processed” at high temperature, will be briefly introduced and the more relevant results will be highlighted.