

## **The Law of Corresponding States for Surface Properties of Metals**

R.M. Digilov<sup>C, S</sup>

*Department of Education in Technology and Science, Technion - Israel Institute of Technology, Haifa, Israel*

The surface tension of pure metals is a fundamental material property. It plays a key role in modeling of a large number of practically important processes and phenomena involving crystal growth, adhesion, wetting, surface faceting, sintering, coating, welding and many general-science applications. Of equal importance are its temperature and pressure dependence; the first acts as driving force for the well-known Marangoni convection; the second is closely related to the structure of the interface.

Recent analysis of experimental data shows that even though experimental methods of LM surface tension determination are sufficiently precise, most of the presented values correspond to narrow temperature intervals with linear temperature dependence of the surface tension, including uncertainties of unknown magnitude. In many instances significant disparities exist between of them. Not much is known about the surface tension of solid metals, except for the classic measurements on mercury, no experimental data for pressure dependence of the surface tension of pure metals.

The lack of experimental data is remedied by ab initio calculations, based on theoretical study. A modern theory based on density functional ideas, enhanced understanding of the problem. However, they are unwieldy and do not always enable one to predict reliable values of surface properties as a function of temperature and pressure. Another active research field deals with predictions of the surface tension from bulk physical properties, or via empirical correlations and scaling properties.

We develop the schema for prediction of surface tension of pure metals from the corresponding states principle. Correlation rules for the surface tension, its temperature and pressure dependence have been derived by scaling parameters characterizing the interatomic potential, with the melting point at atmospheric pressure and the atomic volume at the melting point as macroscopic parameters. The inputs required are the melting point at atmospheric pressure and the atomic volume at the melting point. The rules are applied to all normal melting metals including semiconductors above Deby's temperature and not for alloys. They are quantitatively confirmed by available experimental data and show good agreement with experiment.