Liquid-Phase Density Data of High-Melting Metals Under Increased Pressure and Estimation of Critical Point Data

Matthias N. Leitner [C, S] and Gernot Pottlacher
Institute of Experimental Physics, Graz University of Technology, NAWI Graz, Graz, Austria
matthias.leitner@tugraz.at

Critical point data of high-melting metals are of fundamental scientific interest, yet extremely difficult to determine experimentally. This is due to the utterly high temperature and pressure at this unique point in the phase diagram. A method to estimate critical temperature and critical density is to extrapolate the temperature dependent liquid-phase density according to theoretical models. In the past approach, the liquid-phase density of selected metals was therefore measured as accurately as possible by use of an ohmic pulse-heating system. With this method, wire-shaped samples are heated from room temperature up into the gas phase by passing a large current pulse through them. As the sample heats up, shadow images of the expanding wire are taken to derive thermal expansion as a function of temperature. From that, density as a function of temperature can be calculated up to the beginning of the gas phase, where the sample explodes. Thus, the extrapolation procedure is limited due to the boiling point of the metal. On the road to estimate critical point data of high-melting metals, the existing high-pressure vessel of the Institute of Experimental Physics is therefore put into operation again. This vessel allows an increase of the static experimental pressure during pulse-heating experiments up to about 4000 bar. As a consequence, the boiling point of the sample and with it the liquid-phase temperature range should be greatly increased. Therefore, it should be possible to obtain density data up to higher temperatures and thus closer to the critical point, which positively affects the reliability of the extrapolation procedure. Results of this ongoing work will be presented and compared to already measured density data under atmospheric pressure.