THE SOUND VELOCITY MEASUREMENTS FOR FLUID IRON IN THE VICINITY OF THE METAL-NONMETAL TRANSITION

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Phase diagram of fluid iron is different from that for the dielectric fluids. There is some evidence that this fluid has two critical points and an extra triple point [1]. However, for a reliable detection of the metal-nonmetal transition of the first kind a direct diagnostics of the transition is required. It is known from hydrodynamics that in a transition from the liquid state to the two-phase state (the liquid with the fine dispersed vapor bubbles distributed in it) the speed of sound decreases discontinuously to very small values. This property of the two-phase state will be used here to determine the boiling curve and the metal-nonmetal transition equilibrium line for fluid iron.

To measure the sound velocity a sample in the form of a foil strip, sandwiched between two sapphire plates is uniformly heated by an electric current pulse. During the heating process the volume of the sample, specific enthalpy, pressure and electrical conductivity are measured by means of the experimental technique [2]. To measure the sound velocity an acoustic disturbance is excited by a laser pulse at the back side of the sample. The emergence of the acoustic wave on the frontal surface is detected by the laser interferometer [3]. The sound velocity is determined as the ratio of the thickness of the sample to the time needed for the acoustic disturbance to traverse the sample. These quantities are directly measured in these experiments.

Preliminary results on the sound velocity measurements for solid and liquid iron are reported in this work. The results are compared with literature data. Based on the comparison an assessment of the measurements accuracy is made.

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