DIRECT MEASUREMENTS OF THE ELECTRICAL RESISTIVITY AND STATE FUNCTIONS ON LIQUID ALUMINUM EXPANDED UNDER A SUPERCRITICAL PRESSURE

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Thin aluminum foil strip (~10 μm) sandwiched between two sapphire plates (~1 mm) is heated by an electrical current pulse for less than 1 μs so that the Joule heat deposited into the sample achieves 4 to 6 the cohesion energy. Such experimental technique ensures sufficiently homogeneous heating and practically one-dimensional expansion of the foil strip. The current through the sample, the voltage drop across its length and the pressure near the sample surface are measured. Pressure is measured using a ruby luminescence line shift technique. From the measured quantities the electrical resistivity and pressure both as functions of density and internal energy are directly determined. Present results show that the dependence of the electrical resistivity on internal energy along isochores acquires a negative slope at a density that is about 3 times lower than the standard solid density indicating onset of a metal-nonmetal transition. The equation of state relations obtained for the transition range are analyzed.