ELECTROPHYSICAL PROPERTIES AND POLYMORPHIC TRANSITION OF THE POWER REACTOR VESSEL STEEL UNDER HIGH PRESSURES AND TEMPERATURES OF STEPWISE SHOCK LOADING

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Vessel chromium-molybdenum-vanadium steels occupy an important place in domestic reactor engineering. The steel reactor vessels with pressurized water experience high static loads at temperatures reaching 300°C in the reactor active zone. In some cases, for example in marine nuclear power engineering, vessel reactor steels, along with static loads, also work under conditions of high dynamic loads and are subject to fluctuations in mechanical and temperature stresses. The range of studies of the thermophysical properties of reactor steels is very wide. In this spectrum, high-temperature measurements of electrical conductivity at elevated pressures are mainly due to the fact that they allow taking into account the electronic contribution to the value of the thermal conductivity coefficient of steels not only at high temperatures, but also at high pressures. In this regard, an experimental-calculated reconstruction of the volume-temperature dependence of the electrical resistivity of steel 15Kh2MFA-A modification B in the extended region of high pressures and temperatures was performed.

Three series of shock wave experiments were carried out, in which a polymorphic bcc-hcp transition of 15X2MFA–A modification B steel was identified, the electrical resistance of steel samples along the phase trajectories of stepwise shock compression was measured, and detected a change in the electrophysical properties of the shocked bcc-phase of steel under pressure range up to 5 GPa. The performed measurements of the electrical resistance of steel samples in combination with a semi-empirical model of the volume-temperature dependence of electrical conductivity made it possible to reconstruct the volume-temperature dependence of the specific electrical conductivity of the hcp-phase of steel 15X2MFA–A modification B in the temperature range of 750–950 K and pressures of 25–70 GPa. The results were obtained under Contract No.1770641334821000138 0/22398/90, as well as on the topic of State Assignment No.AAAA19–119071190040–5.