

**THERMODYNAMIC PROPERTIES OF TELLURIUM ALLOYS  
WITH d-ELEMENTS – NICKEL, IRON, MOLYBDENUM, CHROMIUM***Markelov V.I., Volkovich V.A., Polovov I.B., Ivanov V.A., Rebrin O.I.*

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Design and operation of a molten salt reactor (MSR) directly depend on the selection of structural materials working in contact with the fuel salt. The operation of such a reactor is complicated by high corrosive activity of fluoride fuel salts. In addition to the aggressiveness of fluoride melts, tellurium, being a typical product of uranium and plutonium fission in MSRs, causes intergranular fracture of metals along grain boundaries, which leads to deterioration of mechanical properties and intensification of corrosion processes. To understand the causes of such interaction, it is necessary to study the thermodynamic characteristics of compounds, which tellurium forms with typical d-block metals, i.e. nickel, iron, chromium and molybdenum. The aim of this work was obtaining the thermodynamic characteristics of binary compounds formed in tellurium–nickel, tellurium–iron, tellurium–chromium, and tellurium–molybdenum systems, as well as comparing their formation energies.

The research methodology was based on measuring the potentials of tellurium–metal alloys relative to pure metals. Measurements were carried out using two methods – polarization and chronopotentiometry – at temperatures of 500, 600, and 700 °C in the melt based on the eutectic mixture of sodium, potassium and cesium chlorides.

The experiments revealed that the interaction of iron, chromium, nickel and molybdenum with metallic tellurium exhibited significant deviations from ideality and substantial energy effects. In terms of the Free Gibbs energy change of interaction with tellurium, the studied transition metals can be arranged in the following order: chromium, iron, nickel, molybdenum. Thus, tellurium–chromium system showed the maximum deviation from ideality, while tellurium–molybdenum binary system exhibited relatively weak interaction. Formation of the alloys between tellurium and chromium, iron, and molybdenum can occur even without direct contact: the driving force of such interaction is the transport phenomenon caused by disproportionation reactions. Disproportionation is characteristic of tellurides or compounds of tellurium in intermediate oxidation states.

Thus, the obtained thermodynamic characteristics allow predicting the corrosion behavior of structural materials under molten salt reactor operating conditions and justify the selection of the most resistant alloys.