

Phase formation law and kinetic at high temperature isothermal nitridation of tantalum into high pressure of nitrogen

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The technological processes of refractory metals nitrides synthesis by self-propagating high-temperature synthesis (SHS) methods processed at high temperatures with very high rate. To control and to optimize such processes it is necessary to investigate the mechanism and kinetics of interaction in condition of synthesis (high temperature, high pressure and short times).

In the present work the nitridation kinetics of tantalum and phase composition of products were studied in a wide temperature range (1800-2400°C) and at 1-10 atm nitrogen pressure. The investigation were carried out by using High Speed Scanning Electrothermography (HS SET) method, which allows rapidly interrupting the interaction by quenching of samples (by the rate up to 3.104 o/s). As initial reagents were used 100 µm in diameter tantalum wires (99,98 %) and gaseous nitrogen (99,99 %). The wires were heated by passing direct electric current. Duration of experiments vary from 0.05s up to 10s. The reacted samples were examined by various physicochemical methods (gravimetric, metallographic, XRD-analysis, SEM), which allow to track the phase formation mechanism and the process of kinetics.

It was established that:

1. Nitrogen-rich TaN phase have formed at 5 atm and 2000°C temperature conditions, but [1] authors have shown, that at the same temperature this phase is formed at 10 and higher atmosphere of nitrogen;
2. Kinetic of tantalum nitridation isn't described by well-known parabolic law under investigated conditions. This process occurs in transition zone of kinetic regime to diffusion regime.

Biography

H. Stepanyan has completed her Master's degree at last year from Yerevan State University. She finished her both masters and bachelor degrees with honors. Now she serves as a young researcher at Yerevan State University. Her areas of research include investigation of SHS processes. H. Stepanyan had participations in series international conferences and has papers, thesises. She is a good researcher.

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