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MS-4-P-1707 Al–Ni–Pt Alloy System: Isothermal Sections, Liquidus, Solidus and Reaction Scheme

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Pt-modified nickel aluminide coatings are used in order to improve the high-temperature oxidation resistance of the components of the gas turbines produced from Ni-based superalloys. This explains an interest in the low-Al part of the Al–Ni–Pt system. On the other hand, the interest in the Al-rich part is because of the formation of complex intermetallics attractive for both basic and applied research.

In the present work the phase equilibria in Al–Ni–Pt were studied in the whole compositional region. DTA, powder XRD, SEM/EDX and TEM were applied. The liquidus and solidus surfaces, isothermal section at 1100 °C and partial isothermal sections at 1000, 900 and 790 °C were constructed. The reaction scheme was proposed.

The total compositional region of the ternary phase diagram can coarsely be divided into three peculiar subregions (see Ref. [1] and references therein):

•Above ~70 at. % Al this alloy system is characterized by the formation of complex binary and ternary phases. The boundary Al–Pt phase diagram was completed with the recently revealed high-temperature ‘‘Al_3Pt’’ ξ-phase (*Bmmb*, $a = 1.9718$, $b = 1.6228$, $c = 1.4266$ nm) [2], which was found to extend up to 1.6 at. % Ni. Two ternary structures were identified in this region: χ (*P*31*c*, $a = 1.2095$, $c = 2.6932$ nm), ε_6 (*Pnma*, $a = 2.3119$, $b = 1.6416$, $c = 1.2171$ nm).

•Between ~40 and 70 at. % Al the structures based on the CsCl type configuration dominate. The ternary extension of the Al_2Pt phase (β*) separates the compositional regions extending from Al_3Ni_2 and Al_3Pt_2. At 900–1100 °C no complete separation was revealed between the compositional fields of the β and β* phases. With decreasing temperature the total β + β* field shrinks around the compositional lines Al_2Pt–Al_2NiPt and $AlNi$–Al_2NiPt.

•Below ~40 at. % Al the structures are based on the FCC (Ni, Pt) solid solution. Two ternary structures were identified: γ* (*P4/mmm*, $a = 0.3872$, $c = 0.3548$ nm) and γ♦ (*Cmmm*, $a = 0.7902$, $b = 0.7258$, $c = 0.3932$ nm). The low-Ni limit of the γ♦ phase region, probably extending at low temperatures from Al_3Ni_5, was found to be below 4 at. %.

[1] B. Grushko, D. Kapush, J. Alloys Compd. 594 (2014) 127.

[2] B. Grushko, D. Kapush, J. Su, W. Wan, S. Hovmöller, J. Alloys Comp. 580 (2013) 618.