Accepted Manuscript

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PII: S0925-8388(18)32223-0

DOI: 10.1016/j.jallcom.2018.06.102

Reference: JALCOM 46438

To appear in: *Journal of Alloys and Compounds*

Received Date: 13 March 2018

Revised Date: 6 June 2018

Accepted Date: 10 June 2018

Please cite this article as: E.P. Ryklina, K.A. Polyakova, N.Y. Tabachkova, N.N. Resnina, S.D. Prokoshkin, Effect of B2 austenite grain size and aging time on microstructure and transformation behavior of thermomechanically treated titanium nickelide, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.06.102.

EFFECT OF B2 AUSTENITE GRAIN SIZE AND AGING TIME ON MICROSTRUCTURE AND TRANSFORMATION BEHAVIOR OF THERMOMECHANICALLY TREATED TITANIUM NICKELIDE

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Abstract The size and morphology of Ti_3Ni_4 precipitates, as well as their transformation behavior after isothermal aging, were studied in a Ti-50.7 at.%Ni shape memory alloy with various B2 austenite grain sizes. A 0.3 mm thick band with an accumulated strain of $\varepsilon = 44\%$ (e = 0.6) obtained by cold rolling was used. The samples were then solution-treated at 600–800 °C for 0.3–1 h with subsequent quenching in water to obtain the structure with different grain size (GS) from 5 to 15 μm. The samples were then subjected to isothermal annealing at 430 °C for 1, 3 and 10 h. The SEM observations were carried out using a JSM-6460LV. The microstructure was studied using a JEOL 2100 TEM. Characteristic temperatures were measured using a "Mettler Toledo" DSC. The results of the microstructure study prove that the GS strongly affects Ti_3Ni_4 particle size and morphology, as well as the degree of microscale microstructure heterogeneity, transformation kinetics and transformation sequences. This influence is non-unique and depends on the duration of isothermal annealing. After 1 h of aging, the particle thickness and diameter maintain the nanometer range in the whole GS range of 5–15 μm. The increase of aging time to 3 and 10 h leads to localization of nanosized precipitates in the grain-boundary region, with the width of these regions decreasing with increasing GS. After aging for 1 h, the samples with the GS of 5 μm show the B2→R transformation. The increase in the GS to 15 μm and aging duration to 10 h is accompanied by multiplication of martensitic transformations to four stages. The study explains the influence of GS on the precipitated particle size and morphology, transformation kinetics and staging.