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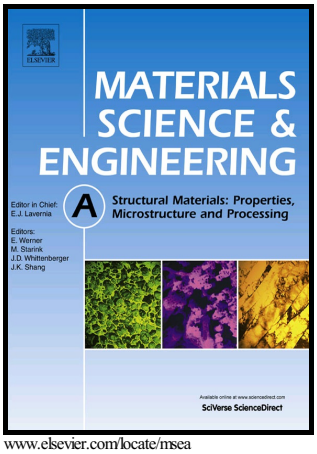

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PII: S0921-5093(17)31632-5
DOI: https://doi.org/10.1016/j.msea.2017.12.038
Reference: MSA35880

To appear in: *Materials Science & Engineering A*

Received date: 29 August 2017
Revised date: 8 December 2017
Accepted date: 9 December 2017

Cite this article as: Seyed Ali Hosseini, Seyed Mehdi Abbasi and Karim Zangeneh Madar, The Effect of Boron and Zirconium on Microstructure and Tensile Properties of the Wrought Nickel-Based Superalloy ATI 718Plus, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2017.12.038

The Effect of Boron and Zirconium on Microstructure and Tensile Properties of the Wrought Nickel-Based Superalloy ATI 718Plus

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Abstract

In the present study, the effect of boron and zirconium on the microstructural characteristics, ductility and the tensile strength of the wrought nickel-based superalloy 718Plus were investigated. In this regard, five alloys with different amounts of boron (0.00 to 0.016 %wt.) and zirconium (0.0 to 0.1 %wt.) were cast via the vacuum induction melting and then purified via the vacuum arc remelting. Microstructural observations were carried out through optical and scanning electron microscopes and phase analysis was performed by x-ray diffraction analysis. The tensile test was carried out at room temperature and 704ºC on the alloys. The results showed a slight effect of boron and zirconium on grain size while they had significant effect on the amount and the stability of the delta phase. These elements increase the lattice mismatch and the elastic strain between the γ and γ′ phases. Boron and zirconium increased the ductility at room temperature by 10% and 12% and at the 704ºC by 8% and 5%, respectively. The effect of these elements on the strength at room temperature was negligible, while at 704ºC, boron and zirconium increased the yield strength by 17% and 16% and the ultimate strength by 8% and 7%, respectively. The improved cohesion and strength of the grain boundaries and an increase in delta phase and the elastic strain between γ and γ′ phases are the most important causes for improving the ductility and strength of the alloy 718Plus in the presence of boron and zirconium.

Keywords: alloy 718Plus, boron, zirconium, microstructure, ductility, strength.

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