

https://dspace.org/

Investigation of the C-Ni-V ternary phase diagram and development of an optimum wear resistant alloy

Fabuyide, Abosede Adefunke

2018

https://hdl.handle.net/10539/26967

Fabuyide, Abosede Adefunke (2018) Investigation of the C-Ni-V ternary phase diagram and development of an optimum wear resistant alloy, University of the Witwatersrand, Johannesburg, https://hdl.handle.net/10539/26967

Downloaded from a DSpace repository. https://dspace.org/

ABSTRACT

The C-Ni-V ternary phase diagram was investigated. The eutectics of ten as-cast samples produced by Apata [2014Apa1] were re-analysed. The results obtained were compared with previous analyses by Apata [2014Apa1] and Muobeleni [2013Muo]. The differences in eutectic analyses were identified. Six new samples were produced and analysed in the as-cast condition, as well as after annealing at 1000°C for 1000hours and water quenched. The phases in the alloys were identified using SEM-EDX, EPMA and XRD. The solidification projection of the new samples was constructed and the extensions of the binary phases were determined. A new liquidus projection was derived using results of the new samples and Apata's [2014Apa1] samples and four ternary invariant reactions were identified, L + ~VC + βV2C → σ′, L + βV2C → σ′ + (V), L + ~VC + σ′ → (Ni) and L + ~VC → (Ni) + C, of which were slightly different from Apata [2014Apa1] and Muobeleni [2013Muo]. The isothermal section of the new sample at 1000°C was plotted

Six VC-Ni alloys (from VC and Ni powders) and seven V-C-Ni alloys (from VC, V and Ni powders) were produced by spark plasma sintering. The sintered density, hardness, fracture toughness, wear performance and corrosion performance in 1M H_2SO_4 and 3.5wt% NaCl environments of the alloys were evaluated. Alloys with 10 at.% Ni had the preferred combination of properties, and Alloy $V_{48:}C_{42:}Ni_{10}$ (at.%) was the optimum alloy with the following properties: 97.6% sintered density, wear rate of 3.03 ± 0.00(1) 10^{-6} mm^3/Nm against a Si_3N_4 ball, corrosion rates of 0.0176mm/y in 1M H_2SO_4 environment, and 0.00295mm/y in 3.5wt% NaCl environment.