

Accepted Manuscript

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PII: S0263-4368(18)30355-X
DOI: doi:[10.1016/j.ijrmhm.2018.08.010](https://doi.org/10.1016/j.ijrmhm.2018.08.010)
Reference: RMHM 4776

To appear in: *International Journal of Refractory Metals and Hard Materials*

Received date: 20 June 2018
Revised date: 15 August 2018
Accepted date: 20 August 2018

Please cite this article as: Ziyong Hou, David Linder, Peter Hedström, Annika Borgenstam, Erik Holmström, Valter Ström, Effect of carbon content on the Curie temperature of WC-NiFe cemented carbides. *Rmhm* (2018), doi:[10.1016/j.ijrmhm.2018.08.010](https://doi.org/10.1016/j.ijrmhm.2018.08.010)

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Effect of carbon content on the Curie temperature of WC-NiFe cemented carbides

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Abstract

We have investigated the effect of the carbon content on the Curie temperature of a cemented carbide composite material with a Ni-Fe alloy as the binder phase and WC as the hard phase. In the carbon concentration range from 5.72 to 5.83 wt.% carbon, which covers the interval where WC coexists with fcc Ni-Fe without other phases (the ‘carbon window’), the Curie temperature rises from 200 to 527 °C. This result indicates the possibility to use the Curie temperature to determine the carbon balance in the system. With thermodynamic calculations and kinetic simulations we can quantitatively establish the correlation between the carbon and tungsten content of the binder phase and the Curie temperature. This strong compositional effect on the Curie temperature is quantitatively very different from the conventional Co-based cemented carbides, with Curie temperatures of about 950–1050 °C.

Keywords: Curie temperature; Cemented carbide; Alternative binder; Carbon window; Hard metals

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