Non-destructive measurement of the tungsten content in the binder phase of tungsten heavy alloys

Measurement of the magnetic properties is well-established to non-destructively monitor composition and microstructure of cemented carbides.

At the 19th Plansee Seminar Stefan Marschnigg demonstrated that this method can also be applied to ferromagnetic tungsten heavy alloys. Compositional changes during heat treatment may have effects on the magnetic properties of W-Ni-Fe heavy alloys, as an example, which would allow for simple non-destructive measurement. He reported that increasing tungsten content in Ni Fe(W) samples and higher annealing temperatures for Densimet 180® grade 95W Ni Fe heavy alloy samples cause a decrease of their respective weight specific saturation magnetization. XRD analyses show that higher heat
treatment temperatures result in larger lattice parameters of the binder phase. Likewise, larger amounts of tungsten dissolved in the nickel iron samples also widen the $\gamma$ Ni Fe lattice. This suggests that the decrease in saturation magnetization of heavy alloys annealed at higher temperatures is caused by more dissolved tungsten in the binder phase. A relationship between saturation magnetization and tungsten content in the binder could be established through the Ni Fe( W) samples with known amounts of tungsten. In view of these results, Stefan Marschnigg proposed saturation magnetization measurements as a simple non destructive tool for additional quality control in the production of ferromagnetic tungsten heavy alloys.

Read the full paper.

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