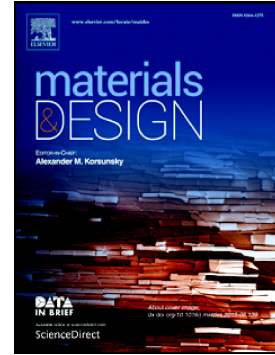


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## Development of a new high entropy alloy for wear resistance: FeCoCrNiW<sub>0.3</sub> and FeCoCrNiW<sub>0.3</sub> + 5 at. % of C.

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A new high entropy alloy (HEA) has been synthesized using a predictive method recently developed. The alloy performance is compared to that of a benchmark commercial alloys (Stellite®6) as wear resistance material for coating automotive engine valves.

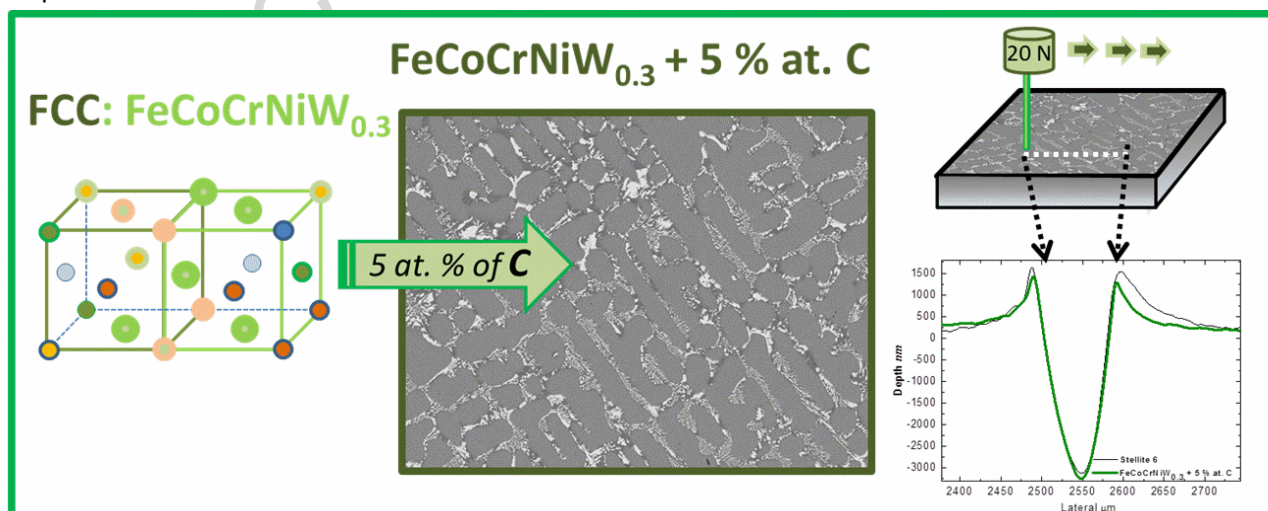
Using step by step predictive parameters the occurrence of an *fcc* solid solution with entropy of mixing higher than the conventional limit of  $1.5 R$  (with  $R$  the gas constant) was singled out and verified in the FeCoCrNiW<sub>0.3</sub> composition. The as-cast ingot displays W segregation within the *fcc* grains as revealed by Scanning Electron Microscopy and X-Ray-Diffraction (XRD) patterns which were fitted by assuming the arc melted alloy contains two solid solutions. The segregation is eliminated by annealing at 1200°C for 3 hours. In these sample a (Co-Fe)<sub>7</sub>W<sub>6</sub>-type phase is found embedded in the solid solution matrix. Slip bands around indentation marks suggest low stacking fault energy of FeCoCrNiW<sub>0.3</sub>. The high entropy alloy (HEA) has been hardened by adding 5 % at. C to form carbides inside the *fcc* matrix. Conventional hardness, scratch and oxidation resistance tests show that the alloy compares well with Co-based Stellite®6 being the content of the expensive and strategical elements halved with respect to it.

**Keywords:** High Entropy Alloy; XRD; Scratch, Hardness; dispersion strengthening.

### Highlights

- FeCoCrNiW<sub>0.3</sub> high entropy alloy predicted and synthesized.
- Slip bands around indentation marks could indicate alloy with stacking fault energy.
- Addition of 5 at. % of C to FeCoCrNiW<sub>0.3</sub> produces hard carbides in HEA matrix.
- Good resistance to oxidation in 700-900 °C range.
- Hardness and scratch hardness compare well with conventional more expensive alloys.

### Graphical abstract



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