Novel High-Temperature Austenitic Alloys for Energy Conversion Applications

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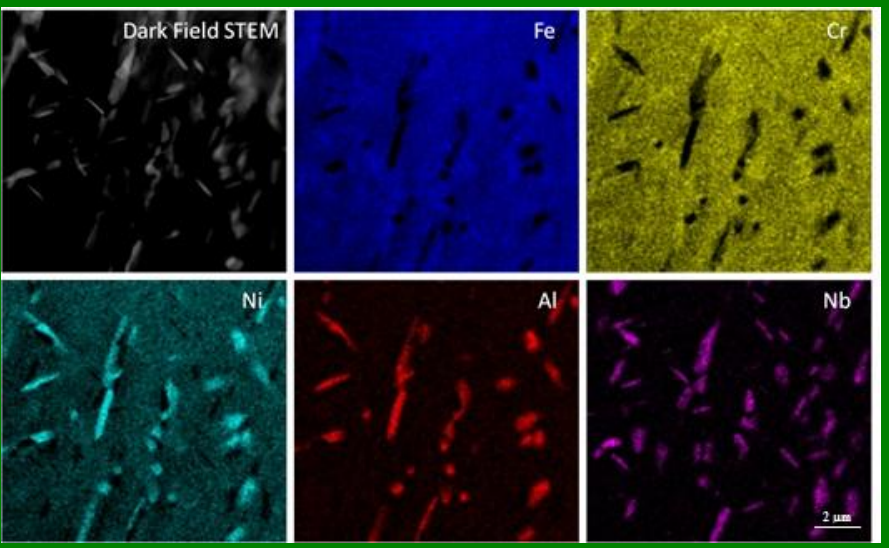

Dark field STEM image (top left) and EDS maps showing concentrations of Fe, Cr, Ni, Al, and Nb in Fe-20Cr-30Ni-2Nb-5Al aged at 800°C for 24 hours and water quenched. Only Nb-rich precipitates are visible.

Solution-treated Fe-20Cr-30Ni-2Nb-5Al (at.%) provides a fully austenitic matrix supersaturated with Nb, which is useful for studying the precipitation of the Laves phase Fe_2Nb (see figure). Such Fe_2Nb precipitates could be used in the future to strengthen and extend the life of materials used in high temperature applications if they are present on a small enough scale.

A number of interesting observations were noted:

- When the alloy was subject to a 90% thickness reduction followed by aging at 800 °C, particles exhibited a finer dispersion than that obtained by simply aging at 800 °C.
- A promising combination that includes a thickness reduction of 90% and subsequent 700°C, 240 h aging treatment exhibited the finest Fe_2Nb precipitates.

The results from this study were promising and a more in-depth analysis of not only Fe_2Nb precipitation, but also NiAl precipitation is currently underway.

1867

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