



Al-containing ferritic oxide dispersion strengthened alloys

mechanical and microstructural properties

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0%-Al

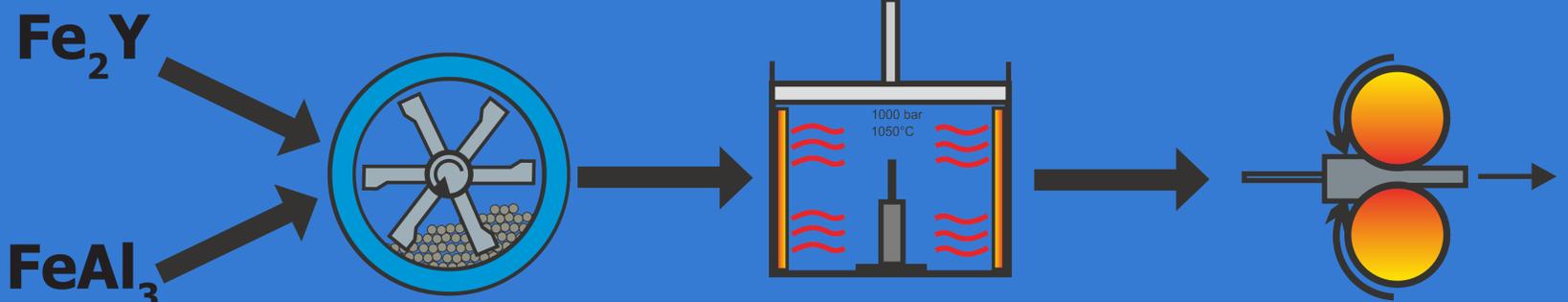
2%-Al

3%-Al

4%-Al

Concepts for future generation nuclear reactors have demanding requirements for the structural materials. High neutron doses, elevated temperature combined with corrosive atmospheres form a harsh environment in which present materials cannot be used. Al-added ferritic oxide-dispersion-strengthened (ODS-) materials have a high chance of meeting these requirements.

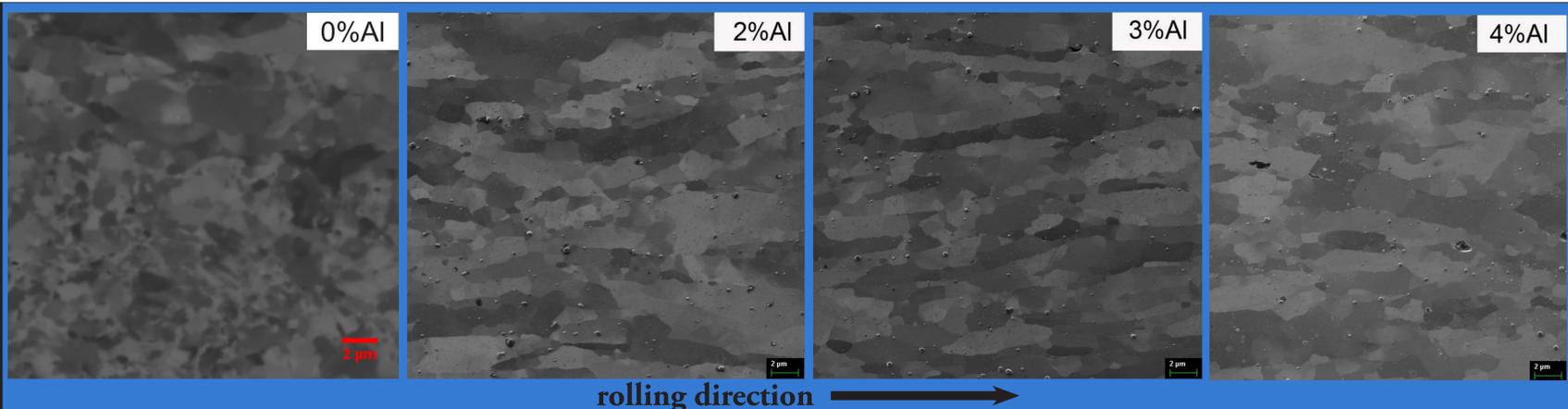
Production



Four different ODS alloys were produced by mechanical alloying of $\text{Fe}_{13}\text{Cr}_{1}\text{W}_{0.3}\text{Ti} + \text{Fe}_2\text{Y}$. The variation of the aluminum content was done by the addition of FeAl_3 intermetallic powder.

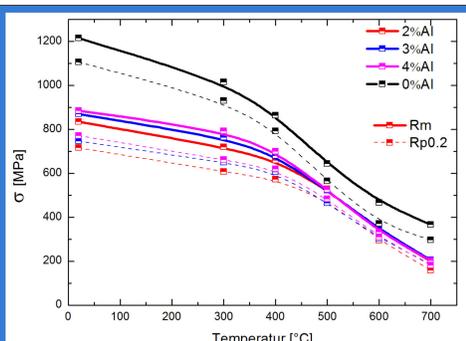
After consolidation via hot-isostatic pressing (1100°C, 100 MPa), the materials were hot-rolled from 45 mm to 6 mm in 5 passes at 1100°C with reheating after each pass.

Microstructure



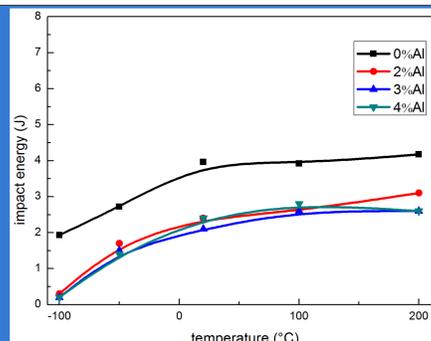
Examination of the microstructure for the materials was performed by focused ion beam. Minor differences were observed in the grain size distribution. The 0%Al-material has a smaller and bi-modal grain size distribution.

mech. Tests



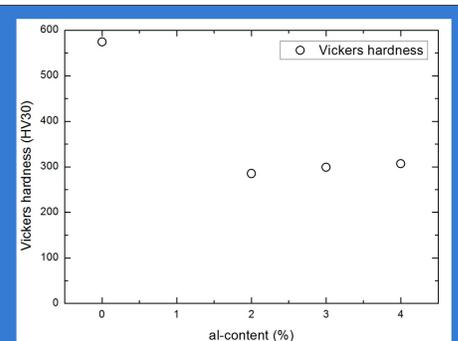
tensile properties

The tensile tests show a significant drop in strength for the Al-added alloys. All Al-ODS materials show similar behaviour in the range of the operating temperatures (600°C)



Charpy impact tests

Nearly no differences can be observed for the absorbed energy and DBTT values. The overall toughness of the 0%Al alloy is higher.



Vickers hardness

Drop of 300HV30 in hardness for the Al-ODS materials.