





Institute for Applied Materials

Karlsruhe Institute of Technology

EUROFER IMPROVEMENT BY OPTIMIZED CHEMICAL COMPOSITIONS

Jan Hoffmann, Michael Rieth, Michael Klimenkov, Siegfried Baumgärtner

Chemical compositions / Heat treatments

No.	Name	Cr	W	V	Та	С	Ν
J361	EUROFER-s	8.7	1.14	0.2	0.09	0.105	0.05
J362	EUROFER-LV	8.7	1.07	0.35	0.1	0.058	0.05
J363	EUROFER-V	8.7	1.08	0.35	0.09	0.11	0.05
J364	EUROFER-LVnoTa	8.7	0.97	0.29	- 📘	0.059	0.05

A series of new 9%-Cr alloys was fabricated in collaboration with OCAS, Belgium. The goal of this study was to expand the operation window of EUROFER97.



A thermo-mechanical treatment (TMT) consisting of Ausforming from 1150°C down to 900°C was performed to optimize the distribution of secondary phases (carbides / nitrides)

Aim: Enable EUROFER for water-cooling applications

Carbon-content has a major influence on phase formation Shift of M_f by 40°C, v_{crit} also increased (still feasible)

Microstructure / Precipitates

J361 /J363 (high carbon content)





2 µm

Fe

Mechanical properties



Coarse **M₂₃C₆** precipitates composition: (Cr14Fe8V0.5Ta.05)C6

J362 / J364 (low carbon content)

- TMT microstructure **not optimal** for Charpy-impact performance!
- Best materials (J362) reached performance of EUROFER97/3 (83699) (after "TMT removal")

- TMT + tempering is effective to gain high-temperature strength
- Mechanical properties can be varied across a wide range

Reduced M₂₃C₆ and TaC precipitates (effect of lower C-content) **VN** precipitates increased (but also size increased)

KIT – The Research University in the Helmholtz Association

This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training Programme 2014-2018 und grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission. The authors are grateful to all their colleagues at the Karlsruhe Institute of Technology.

2 µm

Fe

Contact: j.hoffmann@kit.edu www.kit.edu http://www.iam.kit.edu/ Web: