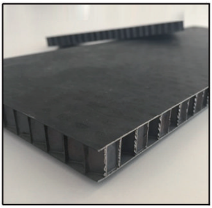
launching PM2000

revitalization of Plansee's ODS-19YAT[11]

ODS-20YAI (PM2017-AM) | NFA-14YWT (PM2018-IT)

high-temp. & corrosion-resistant/irradiation-tolerant ODS/NFA-steels powder & bulk



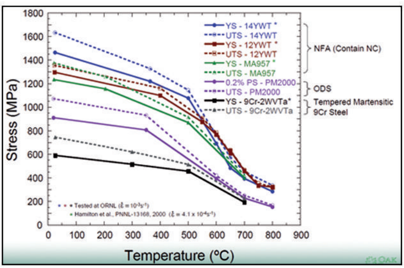
PM2000 honeycomb structures

Simoloyer® CM100-ODS

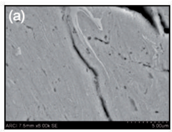
Oxide Dispersion Strengthened | Nanostructured Ferritic Alloys

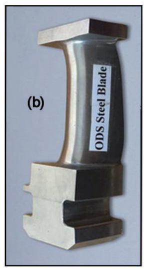
manufactured by high kinetic processing (HKP) ● PM-like process in the Simoloyer®

uniform distribution of dispersoid (nanoscale) ● MA, RM, HEM entirely under Ar, H2, N + vac. (few)



High temperature strength of 14YWT (SM4 heat) is similar to 12YWT and MA957 [4]





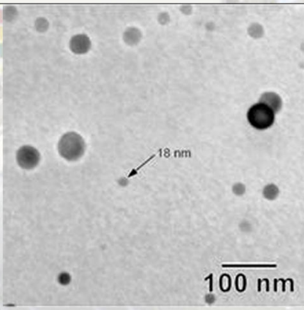
Fe-0.03MOx (CM08, 4h HKP, Zoz-ARCI), grainsize ~15nm (a), ARCI turbine blade (b) and PM2000 burner nozzles [5] (c)

[11] authors (Zoz) discussion and communications with Plansee Composite Materials GmbH Lechbruck am See, 2016-11 through 2017-04-11

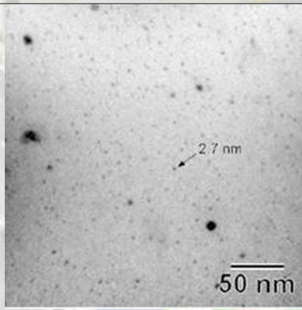
www.zoz.de

[PM2000 | PM2017 | PM2018]

One major focus at Zoz-customers is concentrated on the development and processing of Oxide Dispersion Strengthened Ferritic Steels (ODS). Due to their high temperature stability and strength along with a high irradiation tolerance, ODS-steels represent promising candidates for nuclear fusion and 4th gen. fission reactors likewise for components in gas turbines / aero- and combustion engines exposed to high temperature and high corroding environment.



Plansee PM2000 TEM Bright Field Image



ORNL 14YWT EFTEM Fe M Jump Ratio Map

14YWT contains significantly higher number density and smaller size of Ti-, Y-, and O-rich nanoclusters compared to YAG oxide particles in PM2000 (and other commercial ODS alloys) [4]

[4] D. T. Hoelzer, Oak Ridge National Laboratory: On the Development of Nanostructured Ferritic Alloys for Advanced Fuel Clad Applications in Nuclear Reactors, OZ-16, 9th International | 9th German-Japanese Symposium on Nanostructures (2016), Wenden, Germany, proceedings vol. 9 p-no. V02, S02

Particularly with the goal of achieving better resistance to radiation damage, Nanostructured Ferritic Alloys (NFA) with a dense dispersion of <10nm oxides occuring intra- and intergranulray as precipitates of complex oxides e. g. Y2Ti2O7 formed after a dissolution of starting Y2O3 under the presence of Ti during intense/extended HKP (>20h, >8m/s MRV) and subsequent heat treatment (>1.000°C), were developed [6, 7].

[6] R. DiDomizio, S. Huang, L. Dial, J. Ilavsky, M. Larsen: An Assessment of Milling Time on the Structure and Properties of a Nanostructured Ferritic Alloy (NFA). Metall and Mat Trans A (2014) 45:5409-5418
[7] R. DiDomizio, GE Global Research: The Effects of Processing on Precipitate Distribution and Tensile Properties of a Nanostructured-Ferritic Alloy (NFA), OZ-Workshop 2015 at UCB, University of California at Berkeley, Department of Nuclear Engineering (2015-05-15)

Due to a general renaisseance of powder metallurgy (PM) by additive manufacturing processes (AM, ALM...), also conventional ODS-materials, where coarser "original" oxides >10nm located predominantly on grain boundaries or former particle boundaries [6] homogeniously dispersed by HKP (<4h, >8m/s MRV) opened another focus. The naturally irregular/equiaxial particles after HKP can be modified in morphology by so called spheriodization (SPH) to better meet flowability requirements for AM or MIM [8].

brand	chem. composition (starting mat.)	ID	origin	t. b. on shelf
PM2000	Fe-19Cr-5.5Al-0.5Ti-0.5Y2O3	**19YAT**	ODS-PM	fine-grain/HIP only, D40xL250mm
PM2017	Fe-20Cr-5.5Al-0.5Y2O3	**20YAl**	ODS-RR	powder only (AM, ALM, MIM)
PM2018	Fe-14Cr-3W-0.4Ti-0.25Y2O3	**14YWT**	NFA-GE	t. b. d.
chemical (basic) compositions for on shelf (a) powder and bulk (b) powder only (c) powder and t. b. c.				

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