Viviam Marques Pereira
PhD Student

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Research interests: Phase transformations of steels, microstructures, radiation damage, helium and hydrogen embrittlement, corrosion.

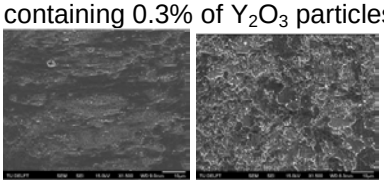
Behaviour of ODS steels under extreme conditions

RECENT RESEARCH ACTIVITIES:

The addition of nanosized Y_2O_3 particles in steels for nuclear fusion reactors is an approach to improve performance at high temperatures (650-700 °C) and also to increase radiation damage resistance; however, the role of oxide nanoparticles regarding radiation damage mechanisms is still not fully understood.

Thus, the main objectives of the PhD project are:

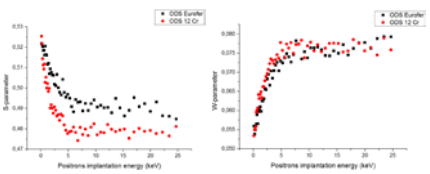
1. Understand what are the effects of high energy particles, He, H, D and T in two ODS steels, namely, ODS Eurofer (with 9% of Cr) and ODS 12 Cr; both steels containing 0.3% of Y_2O_3 particles.



Left: ODS 12 Cr; Right:ODS Eurofer. Etchant: Kallings 1.

2. Characterize the defects formed after exposure to radiation, where they are preferentially formed and, as a conclusion, what is the role of Y_2O_3 nanoparticles in the radiation embrittlement. Techniques to be used:

- **Positron Annihilation Spectroscopy Doppler Broadening (PASDB)** → profile of defects in the steels, evolution of defects with exposure to high energy particles (He^+ ion beam, to mimic effects of neutrons) and temperature;



S-parameter (left) and W-parameter (right) in function of positrons implantation energy for ODS Eurofer and ODS 12Cr, without any heat treatment and implantation (as-received condition).

- **Thermal Desorption Spectroscopy** → Characterization of He and H trapping sites;
- **Small Angle Neutron Scattering** → Size distribution of Y_2O_3 particles;
- **Atom Probe Tomography** → Composition of oxide particles after heat treatments and implantation;
- **TEM** → Characterization of microstructure and oxide particles

3. Study the microstructural stability of these steels at different working temperatures and for different periods of time.

OTHER ACHIEVEMENTS:

- Poster presentation at M2i conference, Dec 11th and 12th 2017, The Netherlands;
- Poster presentation at conference Positrons Studies of Defects 2017, Sep 3rd – 8th 2017, Dresden, Germany;
- Master project supervision on "Radiation damage and thermo-mechanical simulations of a beam stopping device", in development by the student Romy Welschen at CERN, Switzerland, and 3mE TU Delft. Starting period: September 2017.