



3rd International Nanotechnology Conference & Expo

May 7-9, 2018 Rome, Italy

Influence of the Addition of Elemental Zr or Zirconia on the Properties of 14Cr ODS Steels Consolidated by SPS

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The addition of Zr to ODS ferritic steels provides a way to enhance the formation of finer and more stable oxides than those obtained in ODS steels with Y-Ti-Al addition. The formation of zirconium rich nano-oxides may prevent grain growth and refine the final grain size leading to an improvement of the mechanical properties. In addition, another advantage is based on the fact that Zr leads to an improvement in the resistance to the irradiation damage since its oxides exhibit good irradiation tolerance and thermal stability.

In the present investigation, a 14Cr-5Al-3W alloy is modified by adding Ti, Y₂O₃ and Zr in two different ways, as pure elemental Zr powder or as ultrafine ZrO₂ powder. These ferritic ODS steels are processed by high energy milling in a horizontal attritor and subsequent consolidation by SPS. Special emphasis is focused on understanding the differences in the final properties achieved after consolidation depending on the Zr source, and thus on the amount of oxygen available for re-precipitation of oxides during SPS. In order to assess the microstructural properties of these alloys, SEM studies coupled to EBSD mapping are performed. Finally, hardness and micro-tensile tests are carried out to assess the differences in the mechanical properties.

Keywords: 14Cr ODS steel; Zirconium; Zirconia; Nanostructured material; SPS; Mechanical properties.

Biography:

Dr. Andrea Garcia-Junceda graduated in both Chemistry and Materials Engineering at the Complutense University of Madrid. She is currently the head leader of the Solid State Processing Group at IMDEA Materials Institute. This group is collaborating with important research centers and companies in the field of powder metallurgy. The main goal of her group is focused on the design and development of advanced alloys with outstanding properties. She is co-author of 22 journal publications. She has been involved in 12 competitive research projects. At the present time, she is the principal investigator of the FP7 project entitled "PILOTMANU".