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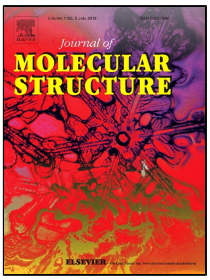

Implementation of GIXRD analysis and nanoindentation technique to study functional properties of materials – ODS case study

M. Frelek-Kozak, Ł. Kurpaska, W. Pawlak, R. Diduszko, J. Jasiński, M. Chmielewski, J. Milczarek, J. Zoladek-Nowak

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Implementation of GIXRD analysis and nanoindentation technique to study functional properties of materials – ODS case study

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Abstract

In this work, the effect of ion implantation and Cr content on structural properties of ODS steel have been investigated. Structural properties were measured by using Grazing Incidence X-ray Diffraction (GIXRD) and Small Angle Neutron Scattering (SANS) techniques. Mechanical properties, in the function of Cr addition were measured by means of nanoindentation technique. It has been found that bands characteristic for (100), (200) or (211) crystallographic planes, upon impact of ions change their position (shift towards lower 2θ). Implementation of Small-Angle Neutron Scattering (SANS) technique has help to estimate particle characteristics in ODS specimens. Finally, mechanical results clearly show impact of Cr addition on the hardness and Young modulus of the manufactured specimens.

Keywords: *ODS steels, ion-irradiation, GIXRD, SANS, nanoindentation*

1. Introduction

Oxide dispersion strengthened (ODS) steels are materials being developed for future nuclear applications, such as elements for the first wall or blanket in the IV generation nuclear reactors [1]. These alloys show high temperature creep resistance, enhanced corrosion resistance as well as excellent mechanical properties [2, 3]. Due to these unique properties, reported materials are able to face harsh environment of nuclear reactor's interior (complex stress fields, intense irradiation, high temperature and aggressive media) [3]. Main factors responsible for their features are: (i) fine-grained microstructure, (ii) high dislocation density and (iii) presence of nanoparticles composed of metallic oxides (Y_2O_3, Al_2O_3 and TiO_2) homogenously dispersed in the base matrix [4, 5, 6]. Another primary alloying element