EPR OF NEUTRON-RADIATION-INDUCED DEFECTS IN GGG

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Gallium gadolinium garnet (GGG) is a one of the most studied garnet materials utilised for its optical and scintillator proprieties when doped with rare earth (RE) ions [1].These properties enable the use of the material in solid state lasers and scintillator detectors. GGG belongs to the garnet crystal family. and is similar in properties to many frequently studied materials. These materials have excellent optical properties as they are transparent and can be doped with RE ions. GGG in comparison to alternative materials has improved mechanical properties, it is more chemically inert and thermally stable.

It is important to study permanent defects induced by ionising radiation in scintillator materials, because they have inhibiting effects on the functionality of the material. Scintillator operation is enabled by the fading of defects that eventually emit electromagnetic radiation close to the visible light spectrum [2].

Multiple paramagnetic defects, which can be detected using electron paramagnetic resonance (EPR) methods, have been reported in GGG [3]. Broad lines with g-factor of ~ 2 have been measured, which were related to Gd clusters.

Radiation-induced centres have been previously reported [4], but mechanisms behind their formation could not be explained.

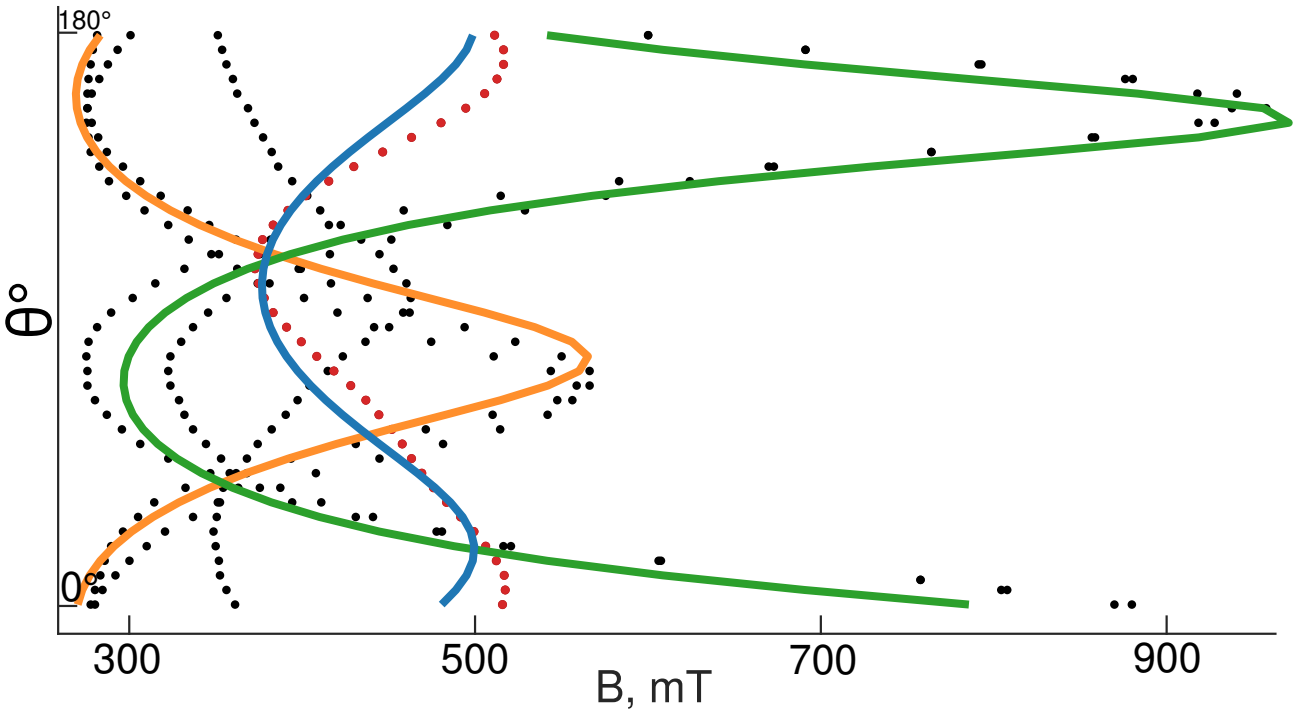

Fig. 1. EPR resonance angular dependence rotating GGG around one of the principal crystal axes. Dots are experimental points and lines represent simulations.

In this study, EPR spectra of neutron radiation-induced defects in GGG have been analysed. The defects possess highly anisotropic g-factors, which are not characteristic for these types of materials. Two distinct types of radiation induced defects in GGG have been observed and mechanisms of their formation are discussed.

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