Deep understanding of advanced optical materials for fusion diagnostic applications

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The industrial progress of 21st century could greatly benefit from development and exploitation of fusion reactors producing environmentally clean friendly electrical energy. One of a key problem here is need in new advanced materials able to operate under extreme conditions (high temperatures and intensive neutron/gamma radiation). Search for such optical and dielectric materials is an essential part of EUROfusion-*Latvia* association activities.

In this talk, I will give short overview of the most interesting results obtained in the framework two EUROfusion Enabling Research Project - "***Advanced experimental and theoretical analysis of defect evolution and structural disordering in optical and dielectric materials for fusion applications (AETA)***" (2019-2020) and "***Investigation of defects and disorder in nonirradiated and irradiated Doped Diamond and Related Materials for fusion diagnostic applications (DDRM) – Theoretical and Experimental analysis*** " (2021-2023).

In the series of joint studies of the Institute of Solid State Physics, University of Latvia, Riga, Institute of Physics at the University of Tartu, Estonia and Karlsruhe Instotute of Technology, radiation damage of some perspective functional materials from priority list of EUROfusion consortium was studied under neutron, proton, heavy ion and gamma irradiations. The optical and dielectric, as well as vibrational and magnetic properties of radiation defects in numerous oxide crystals, nanomaterials and ceramics were carefully studied and compared. Based on this study, we developed new theoretical methods able to evaluate and predict advanced materials functionality and radiation damage evolution under extreme reactor conditions.