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Experimental Evaluation of Long-Term and Stable Magnetic Sensors Operation in ITER-Relevant Conditions

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Radiation resistant sensors and magnetic measuring instrumentation have been designed and its performance in the conditions of fusion reactors have been demonstrated, by the international research collaboration between researchers from different countries supported by STCU (Science and Technology Center in Ukraine) projects and funded from the EU, USA, Japan and Canada.
Created radiation-resistant semiconductor sensors of magnetic field have received an experimental evaluation during their testing in nuclear research reactors, and showed their performance under the conditions of neutron fluences several times higher than the maximum neutron fluence in steady-state sensor locations in ITER reactor (>10x18 n/cm^2).
3D probes with Hall sensors have been successfully tested in European reactors TORE SUPRA and JET. Notably, long-term operation of sensor and equipment has been demonstrated over the period of 5 years (2009-2014) at JET.
Works targeting further increase in radiation resistance and measurement accuracy of magnetic measuring equipment with Hall sensors are currently underway, namely:
• New radiation modification methods of semiconductor sensors have been developed for their parameter stabilization in ITER-like neutron fluxes.
• Materials for sensors with new properties and high sensitivity to magnetic field have been created on the basis of nano-size InAs/i-GaAs heterostructures.
• High precision 3D magnetometers have been created to measure the spatial distribution of magnetic induction vector.
Conducted studies have confirmed the long-term operation of the developed magnetic measuring sensors in ITER-relevant conditions and promising qualities of these development products for DEMO.

Country or International Organisation

Ukraine

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