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Crystal lattice defects induced by swift heavy ions in 3C-SiC: study of repair mechanisms at high temperatures

Abstract:

Silicon Carbide (SiC) is a material with great potential for nuclear, electronic, and space applications as a hard, corrosion, and high-temperature resistant material that can survive in radiation environments. SiC is one of the candidate materials for the construction material for the Dual Fluid Reactor (DFR). DFR is a novel concept of a very high-temperature reactor that can achieve core temperatures in the order of 1000°C.

In the talk, the crystal lattice defects induced by swift Si and C ions on cubic monocrystal Silicon Carbide (3C-SiC) will be presented. The heavy ions were used to simulate the defects produced by neutrons in very high temperature reactors. The target samples were irradiated at room temperature and 800°C to study possible annealing effects. The number of crystal defects was determined experimentally by means of the Rutherford Backscattering method and compared with Molecular Dynamics calculations, supported by the temperature estimation within the ion tracks based on the thermal spike model. Experimental and theoretical results lead to the conclusion that crystal defects formed in SiC by both heavy ions and neutrons can be repaired very efficiently at temperatures around 1000°C, strongly supporting the DFR design. The methods applied in this study can also be used for other ceramic materials of potential interest for very high temperature reactors.

Serdecznie zapraszamy
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Bio:
Ewelina Kucal – is a graduate student in Power Engineering at Poznan University of Technology and currently a PhD student at NCBJ. Her research focuses on radiation damage of ceramic materials such as SiC and ZrC. Her PhD is part of the project "New Reactor Concepts and Safety Analysis for the Polish Nuclear Power Program".