Nuclear engineering researchers revealed fundamentals

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The radiation materials science group at the Texas A&M University led by Dr. Lin Shao, associate professor of nuclear engineering, has made great progress toward understanding the fundamentals of defects in nuclear materials. By using molecular dynamics simulation and the supercomputer facility on campus, the team found a unique mechanism for how grain boundaries in metals remove defects. The knowledge can explain why some alloy structures are better than others for self-repairing of neutron-induced damage in reactor environments.

The defect repairing process is very similar to finding an empty seat in an almost fully occupied room.

"If you want to take the last empty seat in the middle, you have no need to fight for a path by penetrating through and disturbing all the people sitting ahead of you. You can ask everyone on the row stand up and occupy the seat next to him. Therefore, you get a seat with minimum disturbance," said Dr. Shao.

The new finding suggests that a point defect can shoot a chain-like defect toward a grain boundary to recombine with another defect on the boundary. Each defect on the chain only needs to move one small step, but the overall effect is equivalent to moving one defect over a long migration distance.

"The finding is critical to understanding why metals having high density of grain boundaries exhibit higher radiation tolerance. A better radiation tolerance means materials can be used in reactors for a longer time," said Mr. Di Chen, the nuclear engineering Ph.D. student working on the project.

Recently, the results were published by Nature's *Scientific Reports*. The study was funded by the National Science Foundation as a five-year NSF career award project.

More information: www.nature.com/srep/2013/13032 … /full/srep01450.html

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