Radiation tolerant nanotwinned metals

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Texas A&M University mechanical engineering researchers led by Dr. Xinghang Zhang have discovered ratiation-tolerant nanotwinned metals that could provide an important step forward for the design of materials for the next generation of nuclear reactors.

The paper, "Removal of stacking-fault tetrahedra by twin boundaries in nanotwinned metals," was published Jan. 22 in *Nature Communications*.

In nuclear reactors, Zhang said, radiation damage in metallic materials can lead to serious degradation of mechanical properties. Stacking-fault tetrahedron (SFT) is a primary type of defect in irradiated face-centered cubic metals with low stacking fault energy, including copper, silver, gold and stainless steels. The removal of SFT is very challenging and typically requires annealing at very high temperatures, incorporation of interstitials or interaction with mobile dislocations.

During their in situ radiation experiments at Argonne National Laboratory, Zhang's graduate students Kaiyuan Yu and Cheng Sun discovered an alternative route to remove SFTs in nanotwinned silver. A large number of SFTs were removed or truncated during their frequent interactions with abundant coherent twin boundaries, and thus the density of SFTs in nanotwinned silver film decreased sharply compared to its bulk counterpart.

This study provides an important step forward for the design of advanced swelling-resistant structural materials for next generation nuclear reactors.

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