Non-contact measurement of thermal diffusivity in ion-implanted nuclear materials

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Knowledge of mechanical and physical property evolution due to irradiation damage is essential for the development of future fission and fusion reactors. Ion-irradiation provides an excellent proxy for studying irradiation damage, allowing high damage doses without sample activation. Limited ion-penetration-depth means that only few-micron-thick damaged layers are produced. Substantial effort has been devoted to probing the mechanical properties of these thin implanted layers. Yet, whilst key to reactor design, their thermal transport properties remain largely unexplored due to a lack of suitable measurement techniques. Here we demonstrate non-contact thermal diffusivity measurements in ion-implanted tungsten for nuclear fusion armour. Alloying with transmutation elements and the interaction of retained gas with implantation-induced defects both lead to dramatic reductions in thermal diffusivity. These changes are well captured by our modelling approaches. Our observations have important implications for the design of future fusion power plants.

Motivating background

Start with something that everyone in your audience cares about. The background should provide context for your problem or knowledge gap.

Problem statement or knowledge gap

What central question are you trying to answer? Focus in on the specific need that your research addresses; this is the primary motivation for your work.

“Here we show…”

State what you specifically did to solve the problem. Example statements might include: “We simulated/measured XYZ…”

Results

Briefly summarize your main results or conclusions that address the problem statement or knowledge gap. You can include key data but save the fine details for the main document.

Implications

Explicitly state the implications of your findings by linking back to the motivating background. What impact do your findings have on this area of research? Try to answer “so what?” and “now what” questions.