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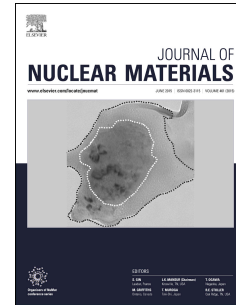
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Hydride formation on deformation twin in zirconium alloy

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ABSTRACT

Hydrides deteriorate the mechanical properties of zirconium (Zr) alloys used in nuclear reactors. Intergranular hydrides that form along grain boundaries have been extensively studied due to their detrimental effects on cracking. However, it has been little concerns on formation of Zr hydrides correlated with deformation twins which is distinctive heterogeneous nucleation site in hexagonal close-packed metals. In this paper, the heterogeneous precipitation of Zr hydrides at the twin boundaries was visualized using transmission electron microscopy. It demonstrates that intragranular hydrides in the twinned region precipitates on the rotated habit plane by the twinning and intergranular hydrides precipitate along the coherent low energy twin boundaries independent of the conventional habit planes. Interestingly, dislocations around the twin boundaries play a substantial role in the nucleation of Zr hydrides by reducing the misfit strain energy.

Key words: zirconium alloys, twinning, hydrides, heterogeneous nucleation of phase transformations, transmission electron microscopy (TEM).

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