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The effect of an atomic hydrogen on the kink formation in a <111>{110} screw dislocation in bcc tungsten: atomistic study

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During D-T nuclear fusion reaction, plasma-facing materials, e.g. Tungsten (W) in ITER, are exposed to a hydrogen-rich environment. Hydrogen is easily absorbed into W and alter the material behavior. Conventionally, hydrogen is well known to cause hardening behavior of materials. Solute hardening is a typical phenomenon associated with hydrogen-induced hardening and it is traditionally understood by dragging or pinning effect as hydrogen atoms impede dislocation motion. On the other hand, enhanced dislocation activity by hydrogen, either by easy kink nucleation or migration, was recently reported, and this observation claims hydrogen-induced softening behavior. In this presentation, we try to reveal the effect of hydrogen on dislocation motion in W, by investigating how the kink nucleation energy barrier changes with the applied shear stress when an atomic hydrogen is around a screw dislocation in W using the chain-of-states method.

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