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# Constitutive law for thermally-activated plasticity of recrystallized tungsten

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## Keywords

Tungsten; constitutive equation; plasticity; deformation stage IV

## Highlights

- Constitutive law for recrystallized W in the low temperature application window
- The effect of deformation stage IV is taken into account
- Model validation by means of finite element analysis

## Abstract

A physically-based constitutive law relevant for ITER-specification tungsten grade in as-recrystallized state is proposed. The material demonstrates stages III and IV of the plastic deformation, in which hardening rate does not drop to zero with the increase of applied stress. Despite the classical Kocks-Mecking model, valid at stage III, the strain hardening asymptotically decreases resembling a hyperbolic function. The materials parameters are fitted by relying on tensile test data and by requiring that the strain and stress at the onset of diffuse necking (uniform elongation and ultimate tensile strength correspondingly) as well as the yield stress be reproduced. The model is then validated in the temperature range 300-600°C with the help of finite element analysis of tensile tests which confirms the reproducibility of the experimental engineering curves up to the onset of diffuse necking, beyond which the

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