**K-Doped 3% Rhenium**

*Properties*

DBTT could be much, much lower than the estimated 600 °C (i.e. 250 °C) [1]

*Recrystallization Embrittlement*

brittle failure is observed in recrystallized materials.

“Consequently, at high temperatures processes of irreversible embrittlement occur in tungsten. A number of authors have related the high-temperature embrittlement of body-centered cubic refractory metals to recrystallization processes” [2].

“isothermal heating decreases the fracture toughness of tungsten by weakening the bonds between its grains; prior recrystallization annealing brings about an irreversible fall in the fracture toughness parameter Kc of tungsten and promotes the creation in this structure of brittle cleavage conditions at stresses which are independent of temperature” [3].

*Recrystallization Suppression via K-doping*

Some limited evidence that doping with K [1] (and indeed Y2O3 [4]) can suppress recrystallization.

*Recrystallization Suppression via addition of Re*

“Rhenium improved the strength and ductility of tungsten in the 20-3000 °C range.” [5]

“Addition of Re to tungsten raised the temperature of incipient recrystallization of tungsten VCh

wire by 200-400 °C, depending on the rhenium content.” [5]

*References*

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[2] A.V. Babak, “Evaluating the crack resistance of tungsten at high temperatures”

[3] A.V. Babak, “Effect of recrystallization on the fracture toughness of tungsten” (1983)

[4] Zan et al., “Recrystallization kinetics of 50% hot-rolled 2% Y2O3 dispersed tungsten” (2019)

[5] Savitskii *et al*. “Properties of Tungsten – Rhenium Alloys”, *Journal of Metal Science and Heat Treatment of Metals* (1960).