Plasma facing materials (PFMs) for future fusion devices like ITER have to withstand severe environmental conditions such as steady state and transient thermal loads as well as high particle \((H, He, n)\) fluxes. The design and the performance of plasma facing components (PFCs) such as the Divertor target strongly depend on the selection of suitable PFMs, e.g. refractory metals, which meet certain predetermined specifications. For the ITER PFCs material specifications have been set up in the past, which may need a further refinement in order to select optimum candidates from a variety of commercially available products. This should help to mitigate material degradation during plasma operation such as macro cracks in monoblock type PFCs, which extend from the plasma facing surface down to the CuCrZr-coolant tube.

For a possible improvement on material specification, 5 different tungsten grades manufactured by different companies and by different densification technologies (forging and rolling) are subject to a detailed materials characterization program. Among the grades are: tungsten produced by Plansee, SE (rod material with uniaxial elongated grain shape), and grades manufactures by Polema, A.L.M.T., MMC (NSMC), and AT&M (plate materials with a plate like grain shape).

The materials are being investigated with respect to the following parameters:

- Uniaxial tensile tests in two directions at a temperature of 800 °C
- Hardness measurement (HV30)
- Microstructural investigations
- Recrystallization sensitivity tests (to be performed at 1300, 1500, and 1800 °C)

Additional material characterization tests were performed to investigate the thermo-mechanical performance of the above mentioned Plansee, SE tungsten product under intense transient thermal loads, which represent typical ELM or disruption like conditions. The thermal tests were performed under electron beam (and/or laser) beam exposure with different energy densities, base temperatures and pulse numbers. Beforehand, the mechanical properties have been measured on test coupons with different grain orientations and different recrystallization states.

The obtained mechanical properties in combination with the thermal shock tests show that the thermal shock damage response strongly depends on the microstructure and the mechanical properties of the tungsten product. High mechanical strength leads to less severe damage formation in terms of crack formation and plastic deformation. Especially recrystallised materials show severe surface damages such as thermal shock crack networks and surface roughening due to the reduced strength and cohesion between single grains.