ODS-KIT HE

In the ductile regime (T ≥ 200 ˚C), the fracture surface consists of flat regions of large dimples, medium dimples (mean size 3.2 µm) and fine dimples (mean size 0.7 µm) as can be seen from the SEM image of the fracture surface in the C-R orientation tested at 200 °C (Fig. 1). On the macro scale, at 400 ˚C, the fracture surface exhibits deeper grooves and is more undulating as compared with 200 ˚C. Flat and large dimples, seen on the fracture surface at 200 ˚C become deeper and less flat at 400 ˚C (Fig. 2d and e). At 600 ˚C, the fracture surface looks the flattest and no dimples are seen (Fig. 2f).

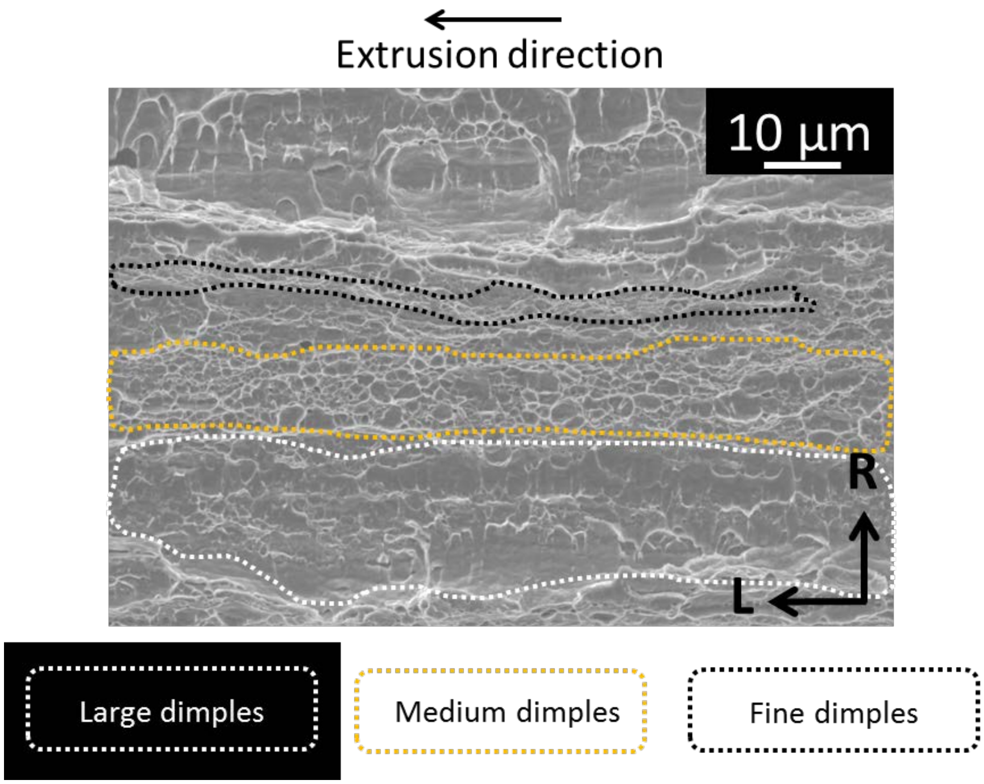

Fig. 1 SEM fracture surface image of ODS-KIT HE at 200 ˚C in the C-R orientation. Three different zones of dimples with different sizes are observed.

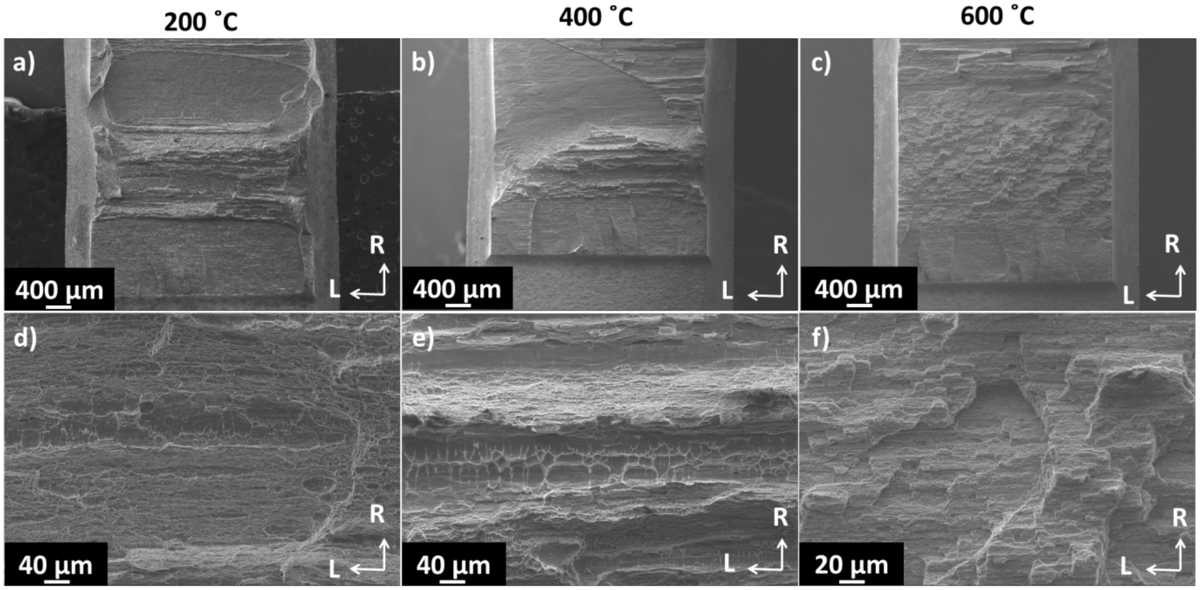

Fig. 2 Fracture surfaces of the C-R oriented specimens at 200 ˚C (a and d), 400 ˚C (b and e) and 600 ˚C (c and f) of ODS-KIT HE.

Fracture surface morphology

The fracture surfaces exhibit dimples in the ductile regime. The width and the height of a dimple seen on the fracture surface, depends on the size and the number density of the void initiating particles. When the particles are densely packed, the dimples are finer as a growing dimple meets its neighbour at short distances and its growth is stopped. When the particles are located far away from each other, the dimples can grow and reach larger dimensions before their growth is stopped by its neighbouring dimple. The pronounced existence of large and medium sized dimple regions in ODS-KIT HE (Fig. 1) in the ductile regime suggest a high number of low number density sub-micron particle regions. The flat regions are not formed due to debonding of oxide coated prior particle boundaries as suggested earlier in some studies [1] but are formed due large inter-particle spacing and low ductility. To support this claim, it can be seen from Fig. 2d and e, that the flat region on the fracture surface at 200 ˚C changes into deep dimples at 400 ˚C due to the higher degree of plasticization. This clearly indicates the fracture mechanism to be a typical trans-granular ductile fracture mechanism.

1. Kim, J. H.; Byun, T. S.; Hoelzer, D. T. Tensile fracture characteristics of nanostructured ferritic alloy 14YWT. *J. Nucl. Mater.* **2010**, *407*, 143–150, doi:10.1016/j.jnucmat.2010.09.054.