Properties optimisation of titania microfibers by direct drawing

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Abstract

Ceramic microfibers are interests both in scientific and technological means. One of the main factors that is supporting the use of fibres is their edgeless cylindrical geometry, which for externally applied mechanical stresses can not localize into specific spots to easily cause cracks. Nanostructured polycrystalline titania (TiO_2) microfibres, studied in this work were produced by direct drawing from visco-elastic alkoxide precursors [1,2]. The fibre crystallinity and grain size were shown to depend on applied post-treatment (calcination temperature) conditions. Single fibre tensile tests showed a strong sensitivity of the elastic modulus and the tensile strength to the microstructural features of the fibres. The elastic modulus of as-fabricated fibres increased about 10 times after calcination at 700 $^{\circ}$C, while the strain at failure remained almost of the same percentage of ~1.4% [3]. The highest tensile strength of more than 800 MPa was exhibited by nanoscale grained fibres with a bi-modal grain size distribution consisting of rutile grains embedded into anatase matrix [4]. This structure is believed to have reduced the critical defect size and thus increased the tensile strength. The resultant materials showed properties that were appropriate for reinforcement of different matrixes.

References

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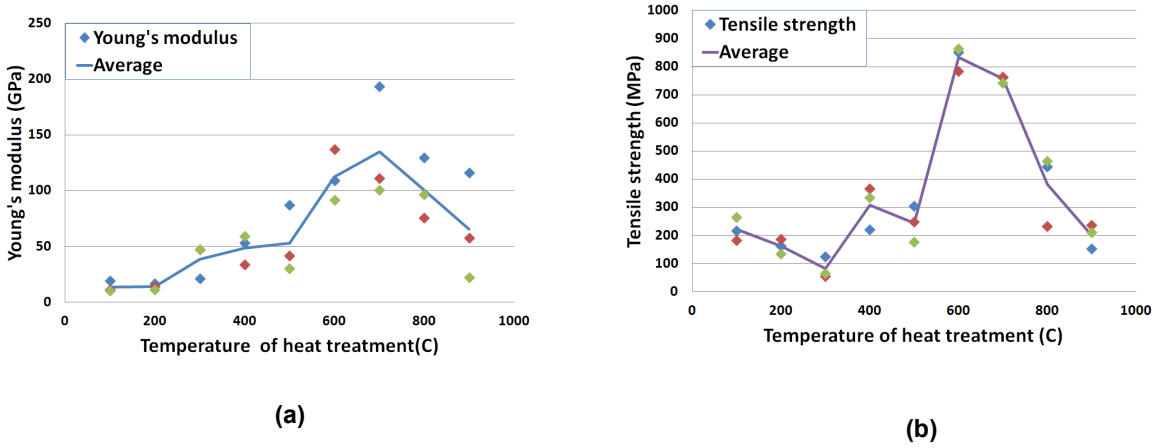
Figures



(a) **(b)**

Figure 1. Changes in modulus of elasticity **(a)** and tensile strength **(b)** with temperature of heat treatment.