Secondary creep of porous metal supports for solid oxide fuel cells by a CDM approach

The creep behaviour of porous iron-chromium alloy used in solid oxide fuel cells (SOFCs) becomes relevant under SOFC operating temperatures. In this paper, the secondary creep stage of infiltrated and non-infiltrated porous metal supports (MS) was investigated and theoretically modelled by a continuum damage mechanics (CDM) approach. The behaviour of the porous metal support, in the range from 1 to 17MPa and temperatures between 650 and 700°C, was combined and compared with data from literature of Crofer® 22 APU, taken as zero porosity reference material. The variation of the elastic modulus as function of temperature, determined by the high temperature impulse excitation technique, was directly used to account for the porosity and the related effective stress acting during the creep tests. The proposed creep rate formulation was used to extend the Crofer® 22 APU Monkman-Grant diagram in the viscous creep regime. The influence of oxide scale formation on creep behaviour of the porous MS was assessed by comparing the creep data of pre-oxidised samples tested in reducing atmosphere.

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