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Influence of short-term ageing prior to high temperature creep of ferritic creep-resistant P92 steel

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Tungsten modified 9%Cr ferritic steel (ASTM Grade P92) was aged at 650 °C for up to 5000 h prior to creep testing. The creep behaviour of this steel in the as-received condition and after different isothermal ageing exposures prior to creep was investigated at 600 and 650 °C and at the initial applied tensile stress ranging from 80 to 200 MPa. The results show a detrimental influence of isothermal ageing on creep properties already after very short times of ageing exposure. Microstructure investigations revealed that a significant decrease in the creep life after ageing resulted from changes of the dislocation substructure and instability of Laves phase and $M_{23}C_6$ particles. Large Laves phase particles, which coarsened during creep exposure, served as preferred sites for creep cavity nucleation and their growth and coalescence accelerate degradation process. From similar values of the stress exponents of the minimum creep rate n and the time to fracture m it is assumed that the creep deformation and fracture are controlled by the same operating mechanisms. Damage tolerance factor λ calculated from the obtained experimental creep dates was used to predict the creep fracture modes. Fractographic

experimental study of creep ruptured specimens revealed a dominant transgranular mode and/or its mixture with intergranular fracture one.

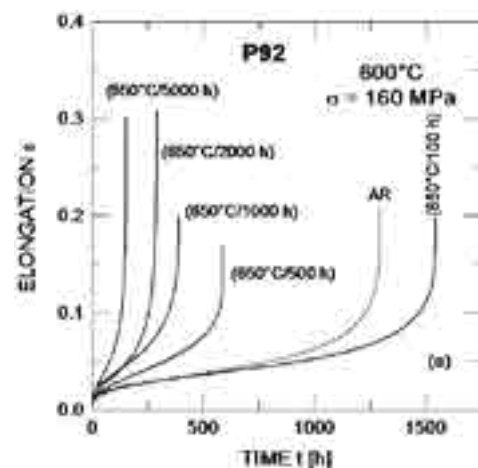


Fig.1: Standard creep curves for as-received and different aged states of P92 steel at 600°C and 100MPa

Biography

Jiri Dvorak has completed his PhD at the age of 31 years from the University of Technology Brno in materials science and engineering. He is a researcher in the Advanced High Temperature Research Group of the Institute of Physics of Materials, Academy of Sciences of the Czech Republic, Brno. He has published more than 50 papers in reputed journals and 20 contributions in the conference proceedings. He is an expert on high temperature processes in metallic materials.

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