

Work-Hardening and Recovery Studies of Pure Aluminium.

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Abstract:

The effects of work-hardening and recovery on the strength of pure aluminium have been investigated. The modes of interaction of these two processes during creep deformation were closely examined. The Bailey-Orowan equation was derived without recourse to a mechanical equation of state. This new method of derivation clearly showed that the Bailey-Orowan equation is applicable only to steady-state but not to transient creep deformation.

The results of recovery tests performed on prestrained samples showed that the flow stress decreased with recovery time, eventually approaching an asymptotic value which was appreciably higher than the flow stress of the annealed sample. It was demonstrated that the recovery rate was not a unique function of the instantaneous dislocation density.

Stress increment and stress removal (state recovery) tests performed on the creeping samples showed the generation of appreciable instantaneous plastic strains during the stress hike, and high strain rates following recovery. Both of these observations are consistent with the promise that creep is recovery-controlled in this material.

Keywords: Aluminium/ work-hardening/ Bailey-Orowan equation / transient creep deformation/ asymptotic value/ recovery rate

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