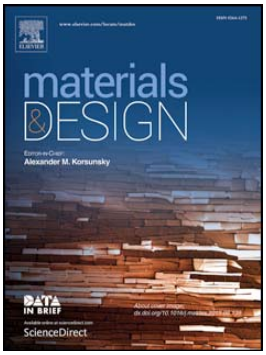

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Proof stress measurement of die-cast magnesium alloys

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Abstract

Magnesium and its alloys exhibit not only elastic and plastic behaviour but also anelastic behaviour upon loading. The presence of anelastic strain poses a challenge to the measurement of proof stress using conventional methods. As such, the proof stress measurement methods specified by American Society for Testing and Materials (ASTM) and International Standards Organization (ISO) are reviewed and applied to three common die-cast magnesium alloys including AE44, AM60 and AZ91. The methods in the standards give inconsistent results due largely to the inherent anelastic behaviour of these alloys. The widely used 0.2% offset strain method tends to underestimate proof stress whilst the 0.2% permanent plastic strain method requires repeated loading and unloading. In view of the fact that the non-equivalence between the offset strain and the residual plastic strain for magnesium alloys is a key obstacle to the accurate proof stress measurement, a conversion chart is constructed to enable the determination of the appropriate offset strain for a desired residual plastic strain for a range of magnesium alloys. It is shown that employing a higher offset strain than 0.2% has an advantage in reproducibility of proof stress measurement.

Keywords: Magnesium alloys; High-pressure die-casting; Measurement; Proof stress; Anelasticity

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