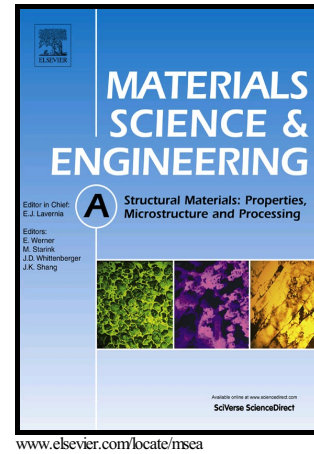


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## Study on the effect of ageing on laves phase evolution and their effect on mechanical properties of P92 steel

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### Abstract

P92 steel is candidate material for application in reactor pressure vessels in nuclear power plants. In present investigation, Laves phase evolution (at 650° C) with varying ageing time (upto 3000 hours) in P92 steel and their effect on mechanical properties have been investigated. During thermal ageing, the microstructure analysis showed the evolution of Laves phase that degrades the strength of P92 steel. The formation of Laves phase was observed after the thermal ageing of 720 h and it showed higher coarsening rate in ageing time range of 720 h -1440 h. The Laves phase formation was also confirmed by the XRD analysis, and line mapping. The strength and ductility decreased as a result of deprivation of solid solution strengthening and formation of Laves phase. The hardness of P92 steel was also affected by ageing time but less pronounced as compared to strength. Charpy toughness was also reduced continuously with increase in ageing time as a result of thermal straining of particles and Laves phase formation.

**Keywords:** Ageing; P92 steel; Laves phase; grain size; precipitate size.

### 1 Introduction

The creep strength enhanced ferritic/martensitic (CSEF/M) steels have been used in nuclear and thermal power plants at temperatures around 650°C [1]. For effective operation of a power generating unit, CSEF/M steels are preferred over high strength low alloy steel and stainless steel [2,3]. P92 steel is a candidate material for advanced fossil and nuclear power generating units because it has good weldability and great mechanical properties at high temperatures [4–6]. The P92 steel is a high-temperature martensitic steel with 9% chromium (Cr) content used for hot-rolled seamless tubes and it was produced by modification of P91 steel,

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