additive on Pt-15Pd-3.5Rh alloy should include at least the mechanisms of the solid solution and of the precipitated phase.

On the other hand, the creep rupture for alloys containing Ce was affected by the stress put on the alloy samples. Figure 10 shows the morphologies of fracture sections of PPR-7 alloy under different loads. The fracture was ductile under higher stress; the tendency to brittleness in the alloys at higher temperatures should also increase. During the longer creep process particles of the precipitated phase grow and cerium oxide is also formed by internal oxidation along grain boundaries.

Conclusions

[1] Increasing the Pd content in Pt-Pd-Rh alloys can increase the strength properties of the alloys at room temperature, but reduce them at high temperatures; the tendency to brittleness in the alloys at higher temperatures should also increase.

[2] Adding a small amount of Ru (for example ≤ 0.5 wt.%) has a good strengthening effect on the Pt-15Pd-3.5Rh alloy from solid solution strengthening and a protective effect from the Ru solute in the alloy matrix being preferentially oxidised and vapourised. Higher Ru concentrations could decrease the mechanical properties at high temperature and increase the tendency to brittleness due to the formation of a large number of porosities and porosity groups or strings.

[3] Ce additions to Pt-15Pd-3.5Rh alloy have a much bigger strengthening effect than Ru additions whether at ambient or high temperatures. Adding a small amount of Ce (for example ≤ 0.1 wt.%) can greatly increase the mechanical properties of the alloy by strengthening mechanisms in the solid solution and secondary phases. Ce additions of higher concentrations are not desirable for strengthening Pt-15Pd-3.5Rh alloy because of the growth of secondary phase particles along grain boundaries.

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Videos of Palladium Hydride Phases

The storage of hydrogen in metals is one way to provide the fuel needed for fuel cells. Palladium (Pd) and its alloys are well-known absorbers of large quantities of hydrogen and the mechanisms of this have been reported here frequently, for instance (1). Now scientists in Ukraine, at the Donetsk State Technical University (2), where the Pd-hydrogen system has been studied for several years, latterly by recording optical microscopy, report video evidence of the mechanism of the generation and growth of the reverse $\beta \rightarrow \alpha$ hydride phase transformation in subsurface layers of Pd $\beta$-hydride at 270–100°C (3).

References