

Industrial Member Report Summary – Key Findings for Industry

High Temperature Corrosion Testing in Oxidising/Carburising and Metal Dusting Environments

TWI Core Research Programme

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Industrial need

TWI has previously developed several test facilities in response to increasing Industrial Member needs for data pertaining to material performance in high temperature service, including but not limited to, oxidising, carburising, metal dusting, biomass burning, molten salt and combustion environments. Due to the variety of environments, any such facility must be flexible with regard to temperature, thermal cycling, flow rates and test gases. There was clear demand for commissioning of a flexible modular test facility as well as detailed research into corrosion mechanisms and corrosion mitigation in demanding service conditions. This included both material selection for high temperature service and appropriate coatings for use in these aggressive environments.

Key Findings

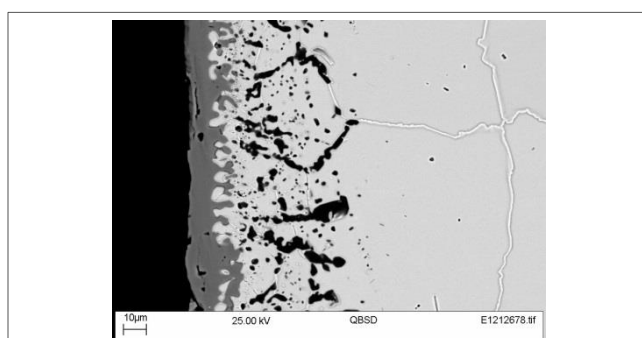
- Facilities were commissioned capable of testing in high temperature gaseous environments at up to 1120°C under ambient pressure.
- At 660°C (in flowing 80%CO-20%H₂) Alloys 800HT, 600, 602CA and 310 stainless steel were resistant to metal dusting and oxidation, but P91 steel experienced both in 336h. Carbon was formed as a by-product.
- A complex proprietary oxide powder reduction environment could be simulated within this cell using flowing 90%CO-2.5%H₂-Ar at 1100°C with samples submerged in fine TiO₂ powder.
- In this simulated environment, Haynes[®] 230 and Alloy 625 performed well, with Alloy 600 showing good but slightly lesser performance. Kanthal APM showed the least resistance. Alloy surface finish did not significantly affect resistance to the environment.
- A beta-aluminide coating could partially protect against this environment but any local failure lead to extremely heavy localised attack.

How to benefit from this work:

- As an Industrial Member of TWI, you have free access to [the full report](#)
- If you are not an Industrial Member of TWI, find out how your company could benefit from Membership www.twi.co.uk/membership
- Contact roger.barnett@twi.co.uk to learn more



High temperature corrosion cell, accommodating 310 stainless steel test vessel. Safety shielding is not shown in this photograph.



Alloy 601, heat treated for >12h in air at 1050°C then exposed to flowing 90%CO-2.5%H₂ at 1100°C for 336h while submerged in TiO₂ powder