

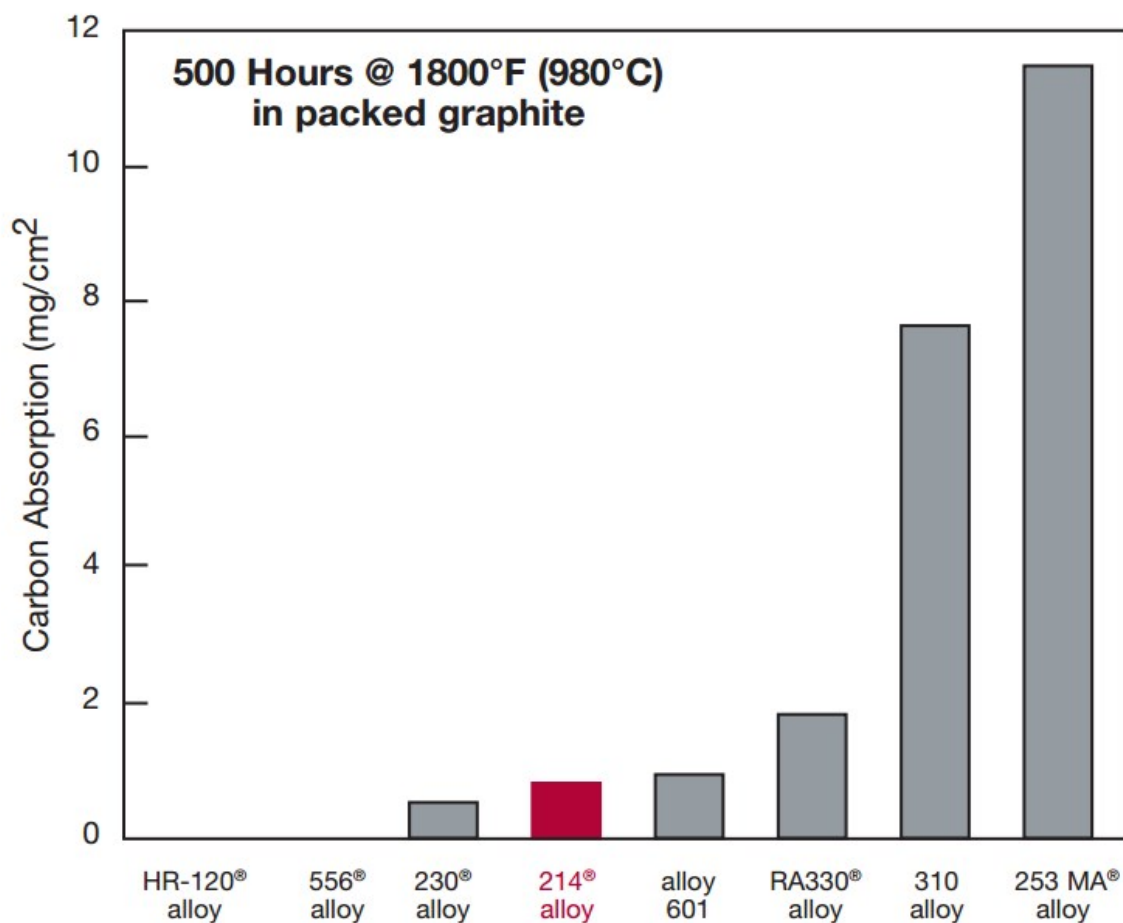
HAYNES[®] 214[®] alloy

Carburization Resistance

HAYNES[®] 214[®] alloy has very good resistance to carburization, as measured in both packed graphite exposure tests and mixed gas exposure tests. Results for these tests are presented in the following pages. All results are presented in terms of the mass of carbon absorption per unit area, which was obtained from the equation $M = C(W/A)$ where M = the mass of carbon absorption per unit area (mg/cm^2). C = difference in carbon (weight fraction) before and after exposure, W = weight of the unexposed specimen (mg) and A = surface area of the specimen exposed to the test environment (cm^2).

Packed Carburization Resistance

Carbon absorption observed for 214[®] alloy following 500 hour exposure in packed graphite at 1800°F (980°C) was very low, as shown below. While superior resistance was exhibited by HAYNES HR-120[®] and 556[®] alloys, other alloys tested exhibited significantly greater carbon absorption. In particular, the resistance to carburization of 214[®] alloy was far better than that for the stainless steel type materials.

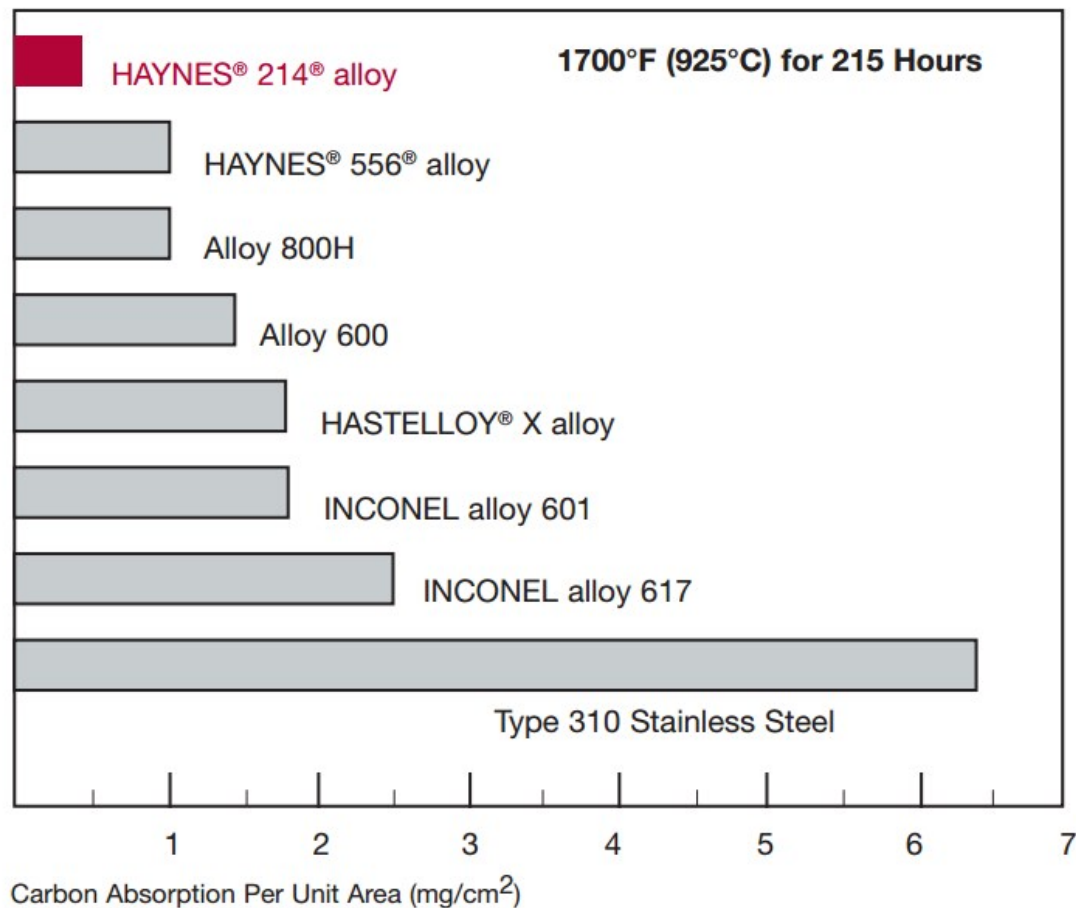


Mixed Gas Carburization Tests

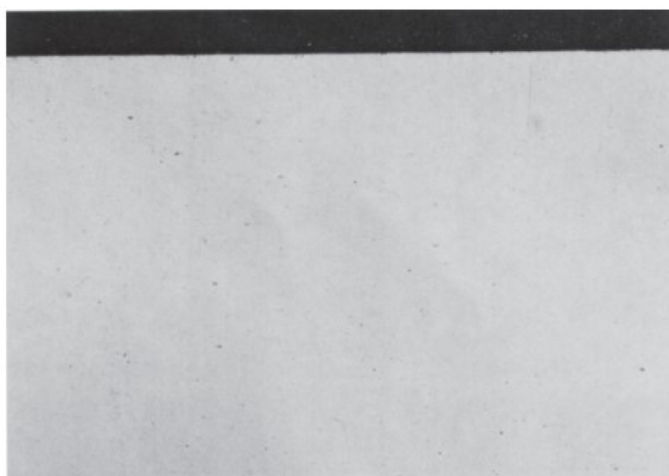
Carbon absorption observed for 214[®] alloy following exposure at both 1700°F (925°C) and 1800°F (980°C) to a carburizing gas mixture was significantly lower than that for all other materials tested. This is shown in the graphs on the following pages. For these tests, the exposure was performed in a gas environment consisting of (by volume %) 5.0% H₂, 5.0% CO, 5.0% CH₄ and the balance argon. The calculated equilibrium composition for the test environments are shown together with the results on the following pages.

Comparative 1700°F (925°C) Mix Gas Carburization Tests

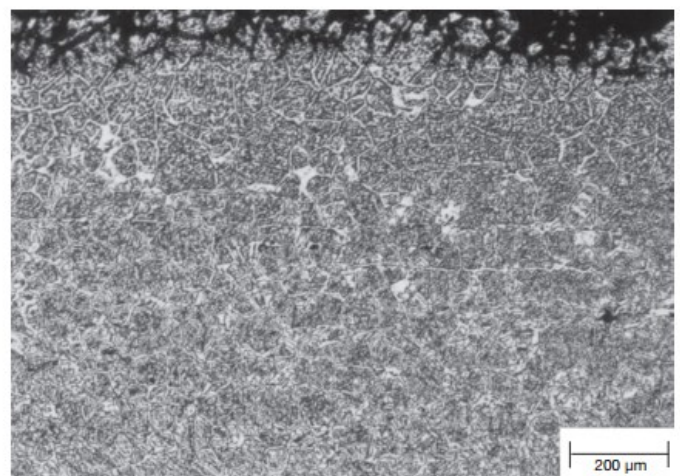
The calculated equilibrium composition (volume %) at 1700°F (925°C) and one atma was 14.2% H₂, 4.74% CO, 0.0044% CO₂, 0.032 CH₄ and balance Argon. The activity of Carbon was 1.0 and the partial pressure of Oxygen was 2.47×10^{-22} atma.



Typical Carburized Microstructures (Unetched) After Exposure For 215 Hours At 1700°F (925°C)



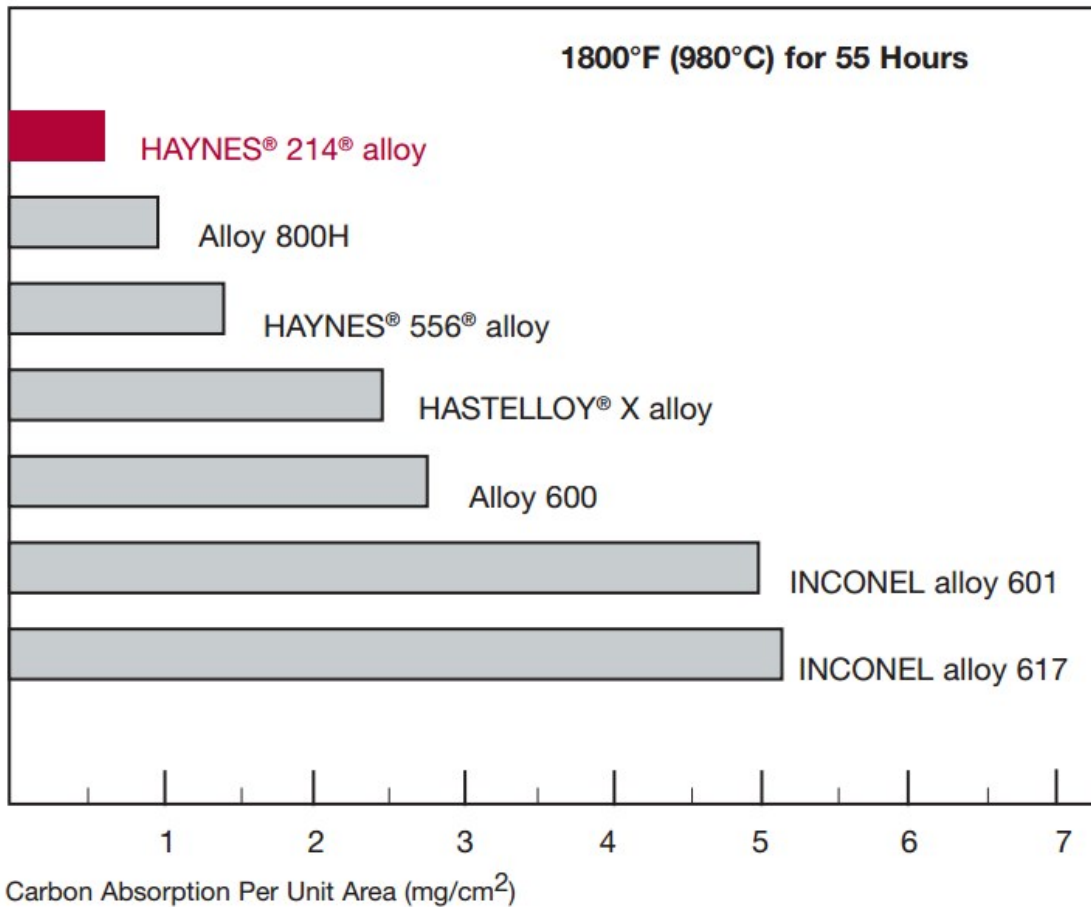
HAYNES® 214® alloy



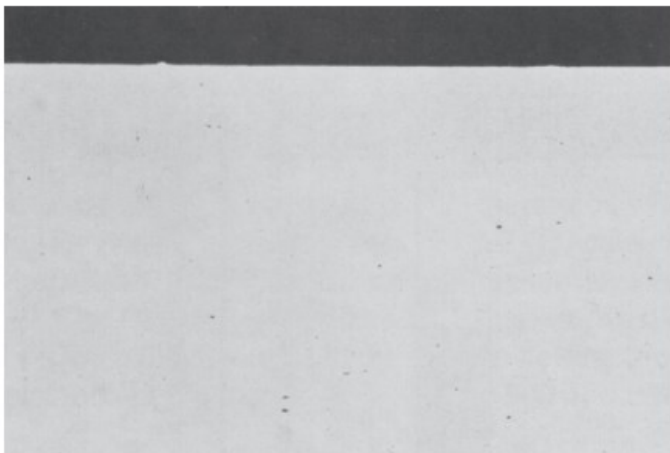
Type 310 Stainless Steel

Comparative 1800°F (980°C) Mixed Gas Carburization Tests

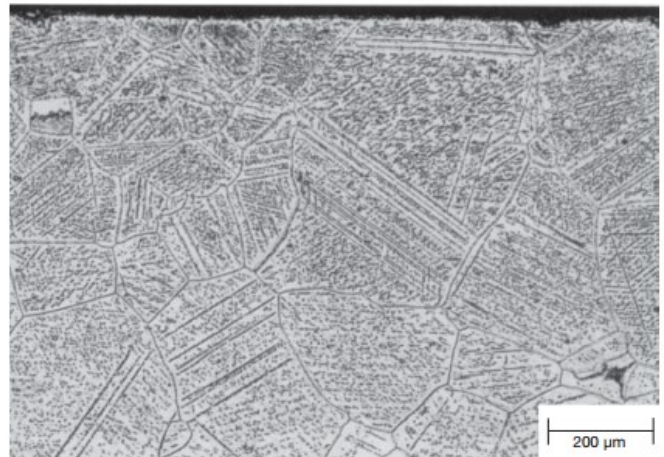
The calculated equilibrium composition (volume %) at 1800°F (980°C) and one atma was 14.2% H₂, 4.75% CO, 0.0021% CO₂, 0.024% CH₄, 0.0098% H₂O and balance argon. The activity of Carbon was 1.0 and the partial pressure of Oxygen was 6.78×10^{-22} atma.



Typical Carburized Microstructures (Unetched) After Exposure For 55 Hours At 1800°F (980°C)



HAYNES® 214® alloy



INCONEL alloy 617

Note: Alloy 617 is carburized to the center of the sample.