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Annexure M:

Technical Note » INCOLOY 800 series

Sourced and Abstracted from INCO Alloys International Technical Product Literature

The Story of INCOLOY series from 800 through 800H, 800HT

INCOLOY nickel-iron-chromium alloy 800 was introduced in the market in the 1950's to fill in the void for a heat- and corrosion- resistant alloy with relatively low nickel content since nickel was, at that time, designated as a "strategic" metal. Over the last 50 years it has been widely used for its strength at high temperatures and its ability to resist oxidation, carburization and other types of high-temperature corrosion. Applications include furnace components, and equipment, petrochemical furnace cracker tubes, pigtails and headers, and sheathing for electrical heating elements.

In 1963, the alloy was approved by the ASME Boiler and Pressure Vessel Committee, and the design stresses were published in Code Case 1325. For the first time, aluminium and titanium were listed as purposeful addition, and annealed material was differentiated from solution-annealed material. The new terms "Grade-1", annealed at approximately 980°C (1800°F), and "Grade-2", annealed at approximately 1150°C (2100°F) came into use. The Code Case covered Sections I and VIII, and listed design stresses for Grade-1 to 593°C (1100°F) and for Grade-2 to 816°C (1500°F).

Over the next few years, the Committee made several revisions. In 1965, extruded tube was accepted as Grade 2 material without heat-treatment. By the following year ASTM specifications has been approved for INCOLOY alloy 800, and these were listed to replace those covering INCONEL alloy 600. In 1967, an external pressure vessel chart for Grade 1 as added, and in the following year the same addition was made for Grade 2.

In 1969, design stresses were increased as a result of changes in the criteria to determine those stresses. The minimum tensile strength curve was increased 10% and the rupture criteria, was increased from 62.5% to 67% of the extrapolated 100,000 hours rupture strength. Six months later, the Case was changed from covering Sections I and VIII to Section I only since the design stresses for Section VIII had been included in Table UNF-23. There were also two sets of design stresses listed for each grade, one giving the values when two-thirds yield strength was used, the other when 90% of yield strength was used.

INCOLOY alloy 800H (UNS N08810)

It has been known for some time that higher carbon content alloy 800 had higher creep and rupture properties than low-carbon material. The company generated data for this material and presented them to the ASME Code. The Code approved higher design stresses for Section I and Division 1 and 2 of Section VII, which appeared in Code Case 1325-7. Note that alloy 800H required only a higher carbon content but also an average grain size of ATSM 5, or coarser.

With the issuance of Code Case 1325-7, and the common use of the term "800H", there was no longer a need to refer to "Grade 2" because it was replaced by 800H, and the material that had been called Grade 1 became, simply INCOLOY 800.

Metallurgical Note:

AcmeCast offers cast equivalent of INCOLOY 800 (UNS N08810), 800H (UNS N08811), 800HT (UNS N08811) that contains higher carbon content than its wrought alloy counterparts (C 0.12% max). Higher carbon content (possible in cast alloys) renders improved high temperature properties, however due to hot metal processing failure limitations higher carbon content is not furnished in corresponding wrought hot rolled or forged bar stocks. Therefore, as a remedy carbon content of 0.08-0.20% is stabilized by combination of Al+Ti up to 1.20% max. As a better alternate, we also offer INCOLOY 800 DIN equivalent Werkst Nummer 1.4859 GX 10/40 NiCrNb 32-20 in which the higher carbon content is stabilized with 0.5-1.5 Niobium (Nb)/Columbium (Cb). Stabilization of carbon with niobium is now known to be superior than combined stabilization with Aluminium and Titanium (Al+Ti). For high performance solutions for your end application contact:

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