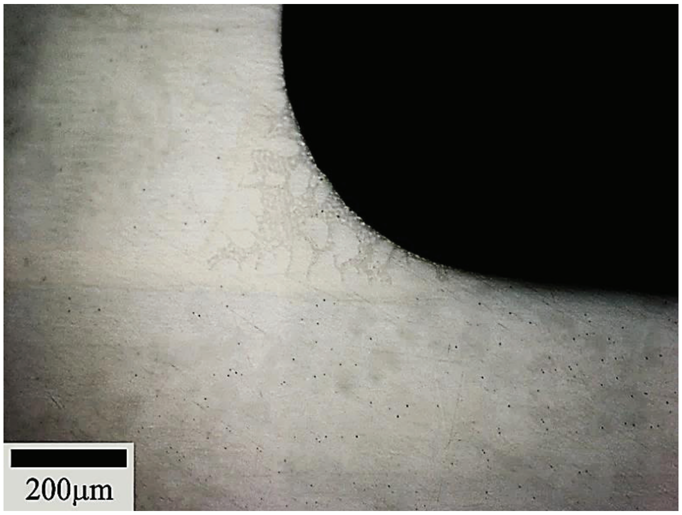
WALLCOLMONOY
HI TEMP BRAZING ALLOYS

WALLCOLMONOY
TECHNICAL DATA SHEET

Nicrobraz® 30 Filler Metals (30, 30b)

Highly Oxidation-Resistant, Low Diffusion Nickel Brazing Filler Metals for High Temperature, High Stress Applications



Typical braze joint and filet for Nicrobraz® 30 brazed at 1177°C (2150°F)

Description:

Nicrobraz® 30 filler metals are ideal for joining components used in many high temperature, high-stress applications. The filler metals' oxidation resistance and strength are equal to the best high-temperature service filler metals. The filler metals flow freely, and have low diffusion and low erosion characteristics at a brazing temperature of 1190°C (2175°F).

Nominal Composition - % by Weight:

Powder, Paste, and Transfer Tape:
Applicable Standards: Nicrobraz® 30; AWS A5.8 Classification BNi-5; AMS 4782; GE B50TF81; GE B50A820; GE B14Y3; UNS N96650

C	Cr	Si	Ni
0.06 max	19.0	10.0	Bal

Applicable Standard: Nicrobraz® 30b; AWS A5.8 Classification BNi-5b

B	C	Cr	Si	Ni
1.3	0.06 max	15.0	7.2	Bal

Forms Available:

Powder: 140 F mesh or 325 mesh (106 F or 45 micron) per AWS A5.8. Alternate particle size distribution available on request.

Paste: Powder alloy premixed with proprietary binders to produce viscous paste suspensions.

Upon Request: Also available as transfer tape, sheet, flux powder paste and rod.

Industries & Applications:

Nicrobraz® 30 was first produced by Wall Colmonoy in the early 1950's. The filler metals' design was based on aerospace requirements and according to industry aerospace engineers of the day it contained significantly less oxygen and hydrogen than other alternative powders. Since that time use of Nicrobraz® 30 has expanded to other industries which include:

Aerospace:

- Honeycomb - An Inconel X750 honeycomb panel was brazed with Nicrobraz® 30 for testing. The resulting brazement exhibited good fillets, minimal filler metal flow onto the honeycomb nodes, good high-temperature strength, no core material of face sheet erosion and low penetration of the braze into the base metal.

- High temperature fuel nozzles in jet engines
- Turbine blade hot sections in jet engines

Automotive:
- Catalytic converters

Catalytic Converter

- Heat exchangers
- EGR coolers

EGR Cooler

Physical Properties:

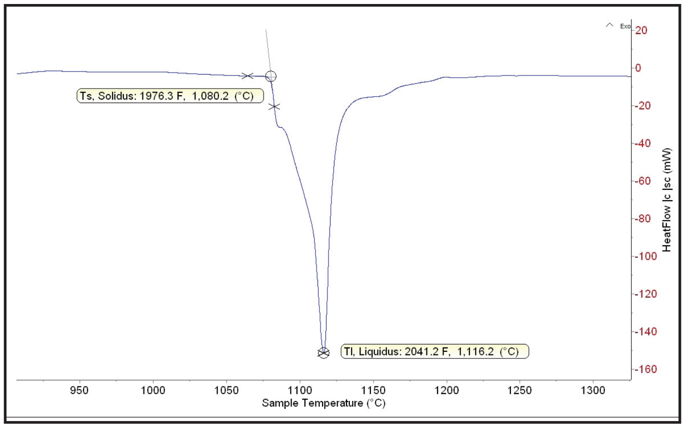
Melting Characteristics

Solidus and Liquidus Temperatures:

Solidus (nominal) 1080°C (1975°F)
Liquidus (nominal) 1135°C (2075°F)

Brazing Range:

1150 - 1205°C (2100 - 2200°F)



Typical thermal analysis plot of heat flow versus temperature for Nicrobraz® 30 by DSC (differential scanning calorimetry).

Diffusion (both liquid-phase and solid-phase) of the Brazing Filler Metal and the base metal occurs during the braze cycle. This produces a new alloy with a higher melting point than that of the original Brazing Filler Metal used. The actual increase in remelt temperature depends on the amount of diffusion that occurs, which itself is dependent on the brazing cycle, joint clearance, type of base metal and amount of filler metal. The higher the brazing temperature and/or longer time at brazing temperature, and the narrower the joint clearance, then the higher the resulting remelt temperature, which can reach 1370°C (2500°F).

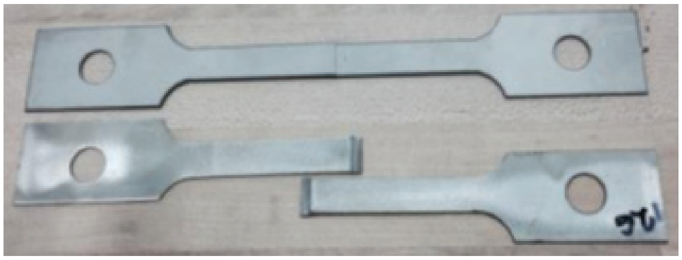
Capillary Flow Characteristics

Good flow characteristics in 0.001 - 0.004" (0.03 - 0.10 mm) clearance joints. Use close fit-up and apply a minimum quantity of Brazing Filler Metal for the best joint properties and the least amount of diffusion.

Joint Strength

On properly brazed austenitic stainless steel and on most non-hardenable base metals, joint strength will be higher than the yield strength of the base metal. Fracture toughness will be sufficient to withstand most mechanical and thermal fatigue stresses. On hardenable base metals, joint strength is widely variable depending on base metal composition and the thermal profile or heat treatment which it has undergone as well as joint design and braze cycle.

Testing of a specific joint design is often necessary to establish joint strength. The following joint strength test data for Nicrobraz® 30 is provided for general information.



Typical Lap Shear Test Specimens
Top: Lap shear specimen before testing.
Bottom: Lap shear specimen after testing (note elongation)

AWS C3.2 Joint Strength Testing on 304 Stainless Steel Brazed at 1177°C (2150°F)

Test Conditions	Room Temperature Testing	
Units for breaking strength in shear or tension	MPa	Psi
2T Lap Joint (0.05 mm joint gap) Shear stress at failure	120.7	17,500
Butt Joint (0.05 mm joint gap) Tensile stress at failure	352	51,000

T = thickness of the base metal used.

The most reliable tests for design purposes are stress rupture or simulated service tests. This kind of testing will define the need for lap-joint geometry of 1T to 4T (where T is equal to the thickness of the thinner of the two metals comprising the lap joint). Generally butt-joints are not desirable, however, testing can determine if they are practical.

Hardness
Brazed joint hardness is usually less than as-cast filler metal hardness and depends on base metal composition, joint clearance, brazing temperature and holding time at brazing temperature. Joint microhardness ranges (Knoop) from 175 - 700, higher temperatures and longer times at temperature resulting in the lower values.

Oxidation Resistance
Excellent through 1205°C (2200°F). Above this temperature, oxidation increases as the temperature increases. Tests were conducted on T-Specimens of alloy 600 (UNS N06600) exposed 500 hours in still air. No fillet deterioration was noticed.

Corrosion Resistance
Proven satisfactory in NaK and high-temperature water media. Tests were conducted by DOE laboratories and industrial manufacturers of nuclear reactors. Corrosion resistance is also good in many other corrosive media, depending upon base metal and brazing cycle. In critical applications, specific tests should be conducted. Corrosion resistance varies with the media involved.

How To Braze:

Nicrobraz® filler metals are manufactured in powdered form. They can be mixed with Nicrobraz® 'S' Binder or purchase as a premixed paste for application with a syringe or air-powered applicator. The filler metals can also be mixed with Nicrobraz® Cement, a liquid plastic binder, and applied as a slurry by brush, eyedropper, or other appropriate means. In addition, they can be sprayed using our NicroSpray™ System. Allow binder to dry before heating.

Furnace Brazing
Recommended braze temperature range is 1150 - 1205°C (2100 - 2200°F). For maximum flow, strength and joint ductility, braze at the high end of the range. For minimum diffusion and solution, braze at the low end of the range, and heat and cool the assembly as fast as possible without producing distortion.

Vacuum of 10^{-3} Torr or lower, or atmospheres of pure dry hydrogen, dry hydrogen/argon blends, argon, or other inert gases (dew point -50°C (-60°F) or drier) are recommended. These protective atmospheres promote excellent wetting of the filler metal to the base metal.

Torch Brazing, Induction Heating, Flame Heating
These methods require the use of flux such as Nicrobraz® Flux for protection against oxide formation. Flux or flux-powder paste must be allowed to dry before brazing. Induction heating may be performed without flux if a suitable atmosphere is provided around the parts.

Safety:

When handling metal powder alloys, avoid inhalation or contact with the skin or eyes. Conduct application operations in a properly ventilated area. For more information, consult, OSHA Safety and Health Standards available from U. S. Government Printing Office, Superintendent of Documents, P. O. Box 371054, Pittsburgh, PA 15250, and the manufacturer's Material Safety Data Sheet (MSDS). Read and understand the manufacturer's material safety data sheet before use.

Storage Requirements:

Keep powders in a closed container and protect against moisture pick-up. The containers should be tumbled before using the powder. If moisture is adsorbed from the atmosphere, it can be removed and flowability can be restored by drying the powder, with the seal removed and lid loosened, at 66 - 93°C (150 - 200°F) for two hours prior to use.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s).
Wall Colmonoy Corporation (USA) assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

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