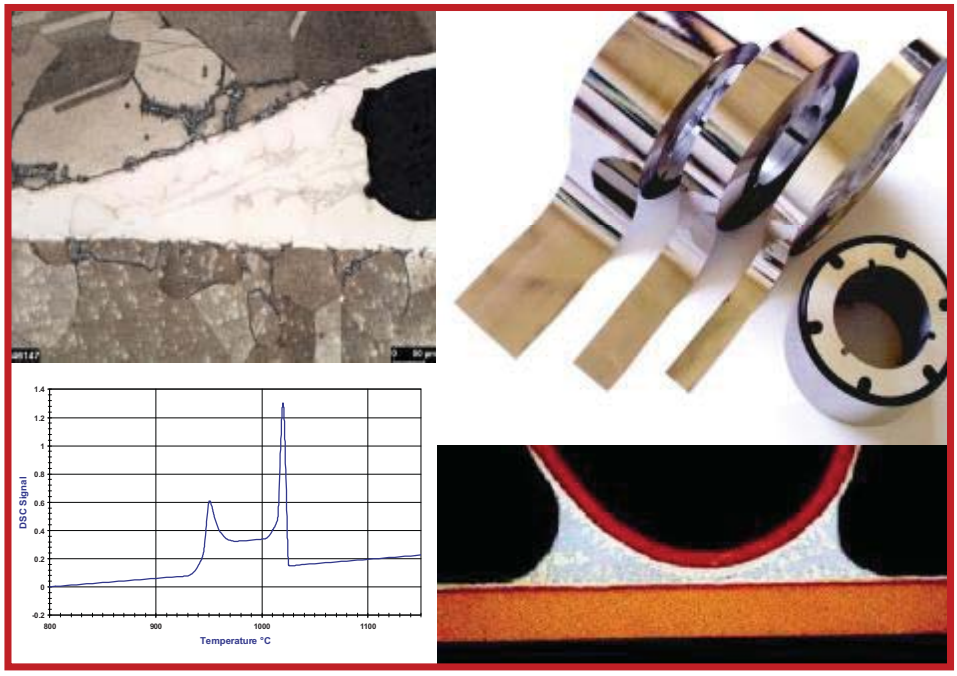
VACUUMSCHMELZE

VITROBRAZE®

Amorphous Brazing Foils



www.vitrobraze.com

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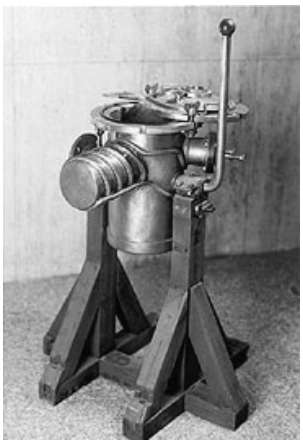
Advanced Materials - The Key to Progress

VACUUMSCHMELZE is one of the world leading companies in the field of development, production and application know-how of magnetic and special materials. VAC research and development is dedicated to ensuring technology leadership in close contact to our customer.

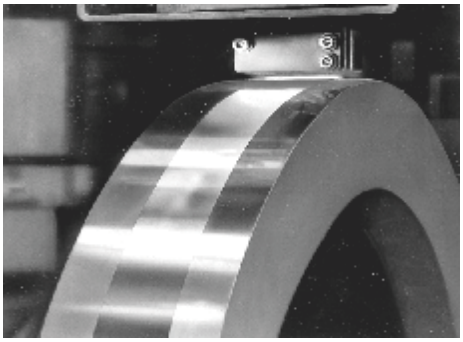


VACUUM INDUCTION MELTING

VAC was the first company to introduce the melting of alloys under vacuum on an industrial scale to reach Ni, Fe, Co Cr alloys with lowest levels of C,N,O H as well as lowest levels of non metallic inclusions (oxides, nitrides, carbides).
The high purity and homogeneity associated with tight tolerances of chemical composition are fundamental for the production of alloys with superior soft magnetic or other unique physical properties as well as for the production of highest grade Rare Earth permanent magnets.

MATERIALS DESIGN

Our ability to tailor the composition and all further processing steps according to our proprietary know how enables us to design alloys with unique properties for specific customer needs.
Our unique materials production routes such as conventional hot/cold rolling, powder metallurgy or rapid solidification start with in-house melting under vacuum conditions.
VACUUMSCHMELZE has outstanding knowledge of the material properties as well as the possibilities for processing them. Our expertise in material design and processing combined with our knowledge of markets and applications secures the development of advanced materials. Our products and technologies are driven by customer requirements. We work with our customers to define materials-based solutions that meet their requirements.

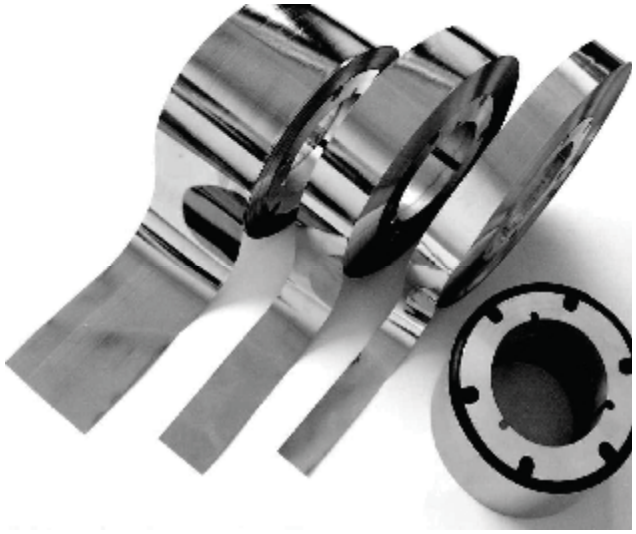


QUALITY ASSURANCE SYSTEM

The quality system at VACUUMSCHMELZE is certified according to DIN EN ISO 9001:2000, on the requirements of **automotive** industry ISO TS 16949:2002, and on the requirements of **aerospace** industry DIN ISO 9100:2003.

VITROBRAZE

In considering of the 5000 years of brazing history, the nickel-based filler metals are a very young group of materials. The first Nickel-BFM (brazing filler metals) was developed for joining parts of aero jet engines in 1947. This new group of BFM's and the brazing procedures therefore were permanently improved in the following decades. Modern alloys of this BFM group are mainly optimized in corrosion resistance and joint strength.



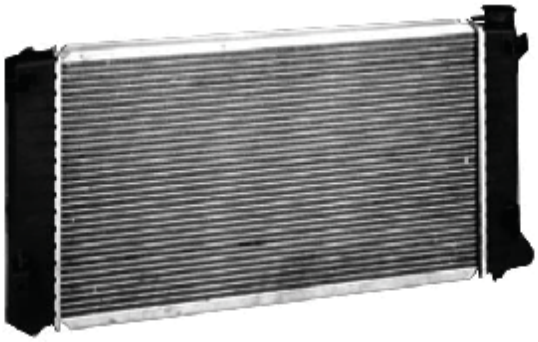
Our amorphous VITROBRAZE® filler metal foils will be produced by the Rapid Solidification Technology which is also used for our soft magnetic VITROVAC® and VITROPERM® products. The production of amorphous metals requires a manufacturing technology that operates on the basis of the necessary cooling rates, which is known as rapid solidification. Amorphous structures are characterized by the absence of a crystal lattice or a long range order. With this random, spatially uniform arrangement of the constituent atoms, their structure is similar to that of liquids.
The nature of this production process is the reason why amorphous alloys are offered in the form of thin, ductile metal foils. Subsequently, tapes, parts and preforms can be made by e.g. slitting, cutting, stamping and etching.

Applications of VITROBRAZE

Nickel filler metals are used for applications where corrosion, oxidation and heat resistance is necessary. A primary merit is the ability to endure high-temperature service, even in moderately aggressive environments. They are furthermore suitable for subzero applications. Nickel brazing foils are used for brazing heat exchangers, EGR coolers, metallic catalysts, food handling components, medical devices as well as naval and other automotive applications. Brazing joints made with VITROBRAZE show a consistence performance with tight and leak free joints. Nickel filler metals can be used for brazing low carbon and stainless steels, nickel and nickel alloys, cobalt and cobalt alloys, and in some cases for special metals and their alloys.

Nickel/Iron filler metals are newly developed brazing alloys for joining of carbon and stainless steel. Primarily these alloys are optimised for mass production of heat exchangers made of stainless steel, like EGR coolers.
These alloys are lower in costs compared to amorphous Nickel filler metals due to their lower content of Nickel.
Joint performance and corrosion resistance is comparable to the well known high-chromium Nickel brazing alloys.

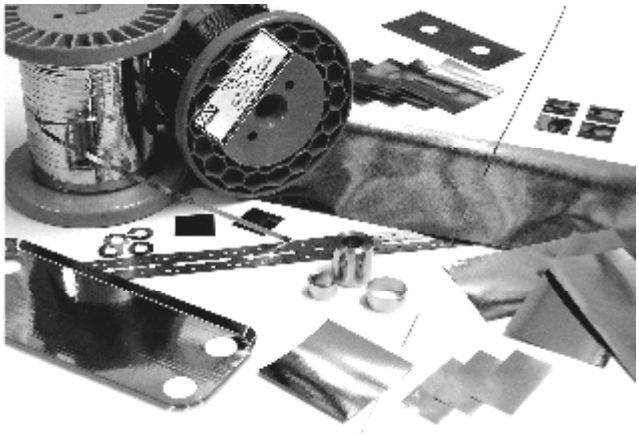
VITROBRAZE **Copper** filler metal foils are very low melting brazing alloys. They are mainly used for a fluxfree brazing of copper and its alloys. These filler metals contain no Cadmium or Lead. Major applications for these brazing alloys are joining of Copper/Brass heat exchangers for automotive and industrial applications. In some cases it is possible to replace expensive silver containing brazing alloys with VITROBRAZE Copper and Nickel alloys.



Advantages of VITROBRAZE

One reason for the superiority of VITROBRAZE products is their amorphous structure. Amorphous materials are compositionally much more uniform, they melt over a narrow temperature range under transient heating. This is a consequence of the shorter distances over which atoms of different elements have to diffuse in order to form a uniform liquid phase. The resulting instant melting, and their superior flow characteristic is only one of the important features of VITROBRAZE. The absence of the residual organic solvent bases evident in powder paste/tapes correspondingly eliminates soot formation and furnace fouling. The low level of gaseous impurities in VITROBRAZE, due to the specific characteristics of its production technology, is an attractive feature for vacuum furnace brazing. VITROBRAZE nickel- and iron base products have no limitation in shelf life. They are available as strip with a width from 0,5 mm to 125 mm and a thickness from 20 µm up to 50 µm. Preforms can be easily produced by using punch and die, cutting/slitting, photochemical etching, and other methods. It is simple to use foils and preforms in automated production and assembling steps.

The use of foils and preforms reduces waste and enhances manufacturing efficiency. Drying and evaporation operations, which are required at powder/paste and tape forms are not necessary. The optimal amount of brazing material can be easily applied to the component, and in just one heating cycle VITROBRAZE creates uniform braze joints with an outstanding quality.



VITROBRAZE overview

Nickel-base **Nominal composition (wt. %)** **Specification Cross Reference Chart**

VAC - Alloy	Ni	Fe	Cr	Mo	Si	B	P	DIN - EN	AWS	AMS
VZ2111	Bal.(75,5)	4,2	13		4,5	2,8		1.)	1.)	1.)
VZ2120	Bal.(82,3)	3,0	7,0		4,5	3,1		NI 102	BNi-2	4777
VZ2133	Bal.(92,3)				4,5	3,1		NI 103	BNi-3	4778
NEW **VZ2135**	Bal.(61,4)	28		2	X	X				
VZ2150	Bal.(73,35)		18,2		7,3	1,15		2.)	2.)	2.)
NEW **VZ2170**	Bal.(70)		21		X	X	X			
VZ2188	Bal.(72,65)	8,2	7,3	3	X	X				

1.) Foil alternative to NI 1A1, BNi-1a, AMS 4776 2.) Foil alternative to NI 105, BNi-5, AMS 4782

Iron/Nickel-base

VAC - Alloy	Fe	Ni	Cr	Mo	Cu	Si	B	P
NEW **VZ2099**	51	29	11,5	1,5		X	X	X
NEW **VZ2106**	35	44	11	1,5	X	X	X	

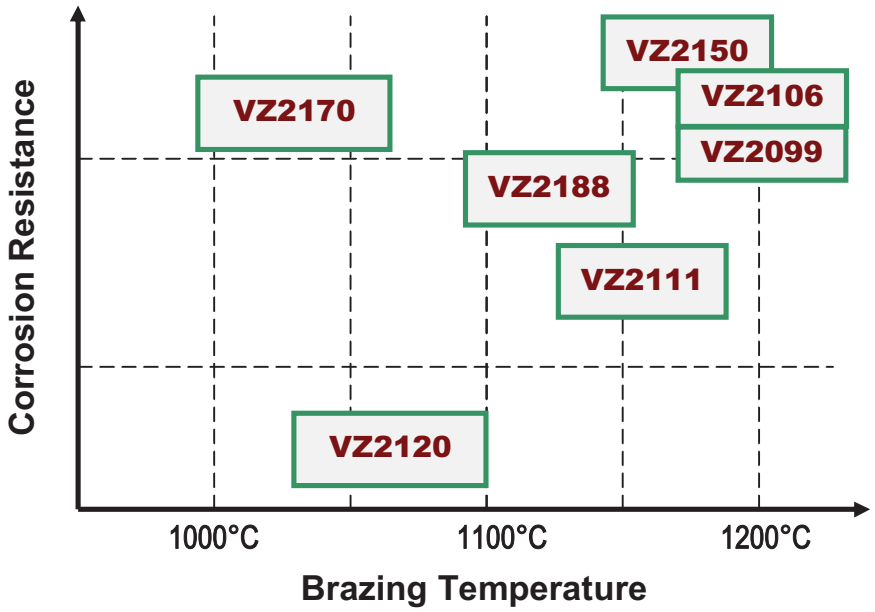
Copper-base

VAC – Alloy	Cu	Ni	Sn	P	Others
VZ2250	Bal.(77,4)	7	9,3	6,3	
VZ2255	Bal.(75,7)	7	9,3	6,5	< 1,5

Physical properties

VAC – Alloy	Solidus Temp. °C *(°F)*	Liquidus Temp. °C *(°F)*	Recommended brazing temp. °C *(°F)*	Amorphous density g/cm^3 *(lbm/in^3)*
VZ2099	934 *(1713)*	1146 *(2095)*	1170 – 1220 *(2140 – 2230)*	7,43 *(0,268)*
VZ2106	1044 *(1910)*	1154 *(2110)*	1170 – 1220 *(2140 – 2230)*	7,46 *(0,269)*
VZ2111	970 *(1780)*	1100 *(2015)*	1130 - 1200 *(2065 - 2190)*	7,73 *(0,278)*
VZ2120	970 *(1780)*	1025 *(1875)*	1030 - 1180 *(1885 - 2155)*	7,82 *(0,283)*
VZ2133	980 *(1795)*	1040 *(1905)*	1060 - 1180 *(1940 - 2155)*	7,95 *(0,287)*
VZ2135	960 *(1760)*	970 *(1780)*	980 – 1180 *(1800 – 2155)*	7,65 *(0,276)*
VZ2150	1040 *(1905)*	1135 *(2075)*	1160 - 1200 *(2120 - 2190)*	7,62 *(0,275)*
VZ2170	880 *(1610)*	925 *(1695)*	980 – 1100 *(1790 – 2020)*	7,70 *(0,278)*
VZ2188	960 *(1760)*	1070 *(1960)*	1080 - 1200 *(1975 - 2190)*	7,72 *(0,279)*
VZ2250	600 *(1110)*	630 *(1160)*	640 - 680 *(1180 – 1260)*	8,25 *(0,297)*
VZ2255	600 *(1110)*	630 *(1160)*	640 - 680 *(1180 – 1260)*	8,25 *(0,297)*

Corrosion resistance of some VITROBRAZE alloys



Comparison of the corrosion resistance of SS316L / VZxxxx brazed joints versus brazing temperature

Datasheets and information´s about further VITROBRAZE products are available by request.