
Glass enamel
搪玻璃瓷釉
ACEMENDER

Full range of Glass lined Products & Service

瓷釉 GP-12 Glass

We have selected two types of enamels produced by Wendel in Germany and a Chinese manufacturer that meet the performance requirements of the current international enamel standard ISO 28721-2 for use in the equipment we sell. We also fully adopt the cold spraying and slow firing enameling process to meet the quality requirements of the ISO 28721-1 standard.

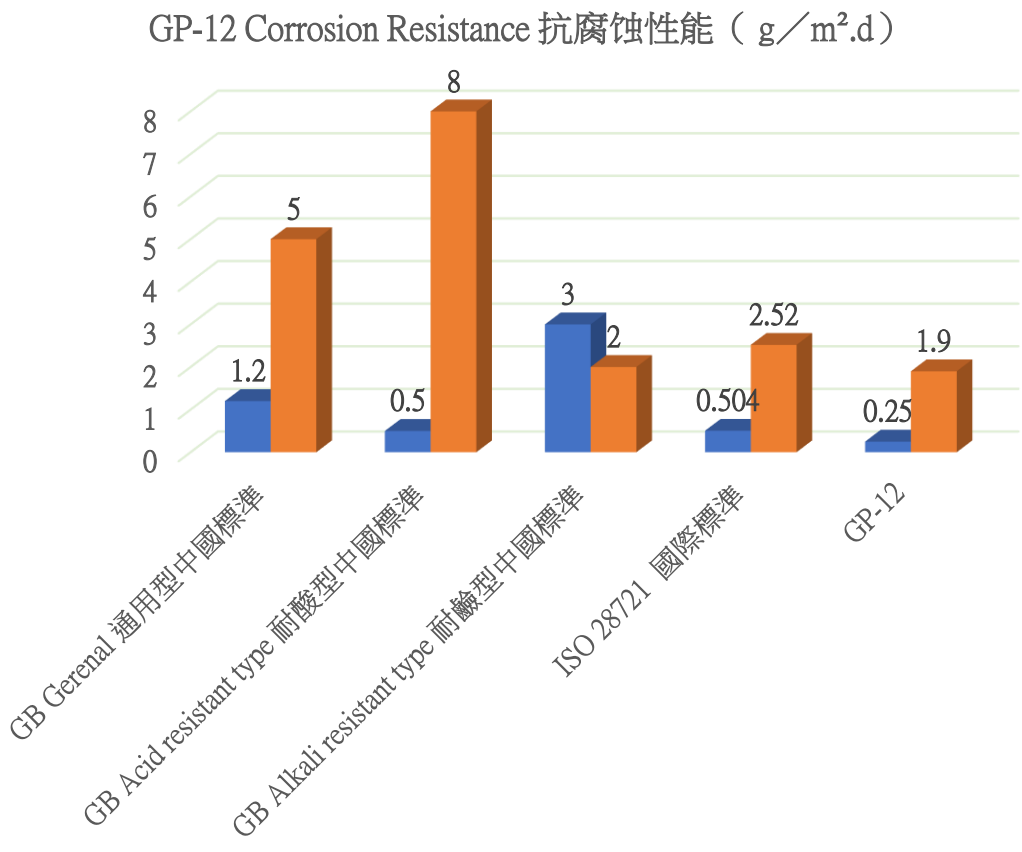
我們精選了德國Wendel產及中國廠商製造的兩款符合現行國際搪玻標準ISO 28721-2 性能要求的瓷釉，為我們所售設備使用，並完全採用冷噴及慢燒的搪燒工藝，以滿足ISO 28721-1標準的質量要求。

名称 Item	计量单位 Unit	试验方法 Test Standard	GB 25025 -2010 中国现行标准 Current Chinese Standards			*1 ISO 28721 现行国际标准Current International Standards	牌号 Type
			通用型 Gerenal	耐酸型 Acid resistant type	耐碱型 Alkali resistant type		GP-12
搪玻璃釉耐沸腾盐酸腐蚀性能 Resistance to Boiling hydrochloric acid corrosion	g／m^2.d	GB/T7989-2013	≤1.2	≤0.5	≤3.0	0.08*6.3= 0.504	0.2 ~ 0.3
搪玻璃耐热氢氧化钠溶液腐蚀性 Resistant to hot sodium hydroxide corrosion	g／m^2.d	GB/T7988-2013	≤5.0	≤8.0	≤2.0	0.4*6.3=2.52	1.8 ~ 2.0
搪玻璃层耐机械冲击性Mechanical impact resistance of glass lining	10^{-3}J	GB/T7990-2013	≥220×10^{-3}	≥220×10^{-3}	≥220×10^{-3}		280 ~ 330
搪玻璃层耐温差急变性Resistance to rapid temperature changes	℃	GB/T7987-2013	≥200	≥180	≥180		210 ~ 250

*1 国际标准所用耐腐蚀数据单位是mm/a，与中国表标准g／m^2.d 不同，需要换算。以瓷釉密度2.3ton/m3计算，**換算系数：mm/a /365days /1000*2.3*1000000 ≈ 6.3** The corrosion resistance data unit used in international standards is mm/a, which is different from the Chinese standard g/m^2.d, so conversion is required. Calculated based on the enamel density of 2.3ton/m3,
charge rate： mm/a/365days/1000*2.3*1000000 ≈ 6.3

瓷釉 GP-12 Glass

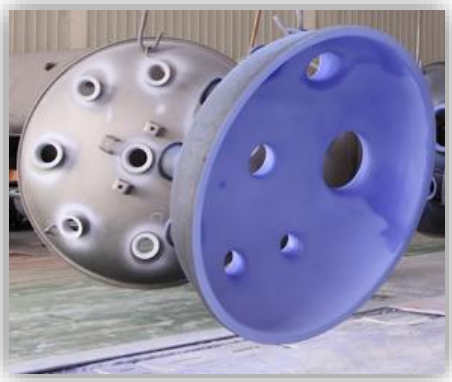
檢測項目 Test item	單位 Unit	數值 Value
軟化溫度 Deformation temperature	˚C	560~580
延伸率 Breaking elongation	%	0.1
抗拉強度 Tensile strength	N/mm^2	70~90
熱膨脹係數 Thermal elongation	10^{-6} K^{-1}	88 ~115
彈性模量 Modulus of elasticity	N/mm	75,000
比熱 Specific heat	J/kgK	835
導熱率 Thermal conductivity	W/mK	1.2
比電阻 Specific electrical resistance	Ωcm	1013
絕緣強度 Dielectric strength	kV/mm	20 ~30



冷噴與熱噴 Spray with “Normal temperature” vs. “ Hot ”

There are two spray processes in Chinese glass lining market, one is spraying on steel plate at normal room temperature, while “hot ” means applying glass on steel plate at about 50 ℃.

- With “cool spray” method, one can not spray heavy thickness each time, but “hot spray” technique will do that.
- Therefore, “cool spray” method makes the compact glass layer, but “hot spray” gets the loose glass layer and with more air bubbles inside.
- Applying “cool spray”, one must wipe off the defects before each firing, but the “hot spray” uses heavy thickness to cover them.



“ 冷噴” 與 “熱噴”

中國搪玻璃業界存在兩種噴粉工藝，一種叫“熱噴”，一種叫“冷噴”。冷噴是鋼板溫度降至正常室溫的噴粉工藝，熱噴則是將瓷釉漿液應用於溫度處於50 ℃左右的鋼板。

- 採用“冷噴”工藝，每次噴粉厚度不能過大；“熱噴”工藝則不能；
- 採用“冷噴”工藝製作的瓷層緻密，“熱噴”工藝製作的瓷層則疏鬆，且夾雜大量氣泡；
- “冷噴”工藝製作時，每次搪燒前，都必須仔細清除各種瑕疵，“熱噴”工藝製作時，則以厚重的瓷層來掩蓋

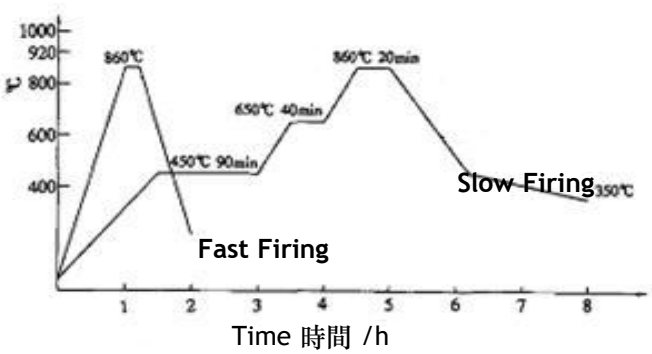
我們只用冷噴和電腦控制慢燒工藝生產
We only used the cool spray & computer controlled slow firing process

Cool Spray
冷噴工藝

Hot Spray
熱噴工藝

瓷層剖面圖，放大20倍，瓷層厚度1.0mm
Magnified 20 times, glass thickness 1.0 mm

快燒與慢燒 *Fast Firing vs. Slow Firing*



Firing Curves 搪燒曲線

Fast Firing vs.. Slow Firing 快燒 比 慢燒

受控的慢燒可以有效地降低搪玻璃設備的殘餘應力。殘餘應力小的設備，搪玻璃各瓷層更加穩定，受冷熱衝擊時溫差應力疊加效應就小。反之，殘餘應力大的設備更容易引起爆瓷。慢燒工藝還有助於釋放鋼坯及瓷釉中的氣泡，使瓷層更加緻密、穩定。

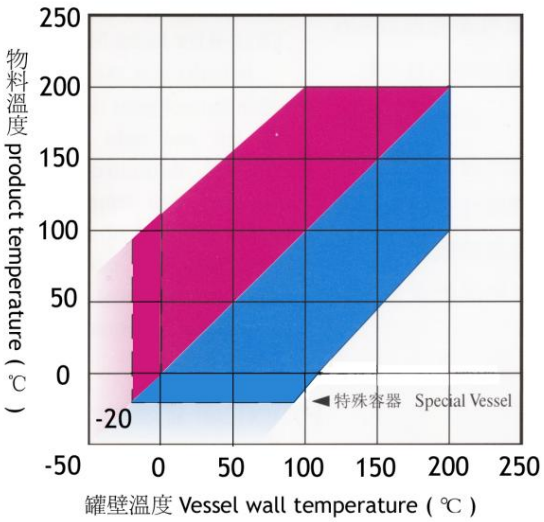
Controlled slow firing can effetely decrease residual stress of glass lined equipment. The less the residual stress, the more stable of each coat of glass lining, which results in less superimposed effect of differential temperature stress against thermal/cold shock. Otherwise, huge residual stress will cause glass failure easily. Slow firing is also helpful to release bubbles inside steel substrate and glass lining, which will make the lining more stable and compact.

影響因素 Influence Factors	冷噴工藝 Cool Spray	熱噴工藝 Warm Spray	慢燒 Slow Firing	快燒 Fast Firing
密著強度 Adherence Strength			好 Good	差 Bad
殘餘應力 Residual Stress			小 Small	大 Huge
緻密性 Compactness	好 Good	差 Bad		
氣孔數量 Number of Air Holes	少 Few	多 Many		
暗泡 Dark Bubbles	少 Few	多 Many	少 Few	多 Many
針孔 Pin Holes	少 Few	多 Many	少 Few	多 Many
發沸 Over-boiled Defects			無 Never	有 Sometimes

溫度衝擊 *Thermal / cold shock*

向搪玻璃設備釜內加 料
Filling a glass-lined unit with a hot or cold medium

加料圖 Diagraph of filling

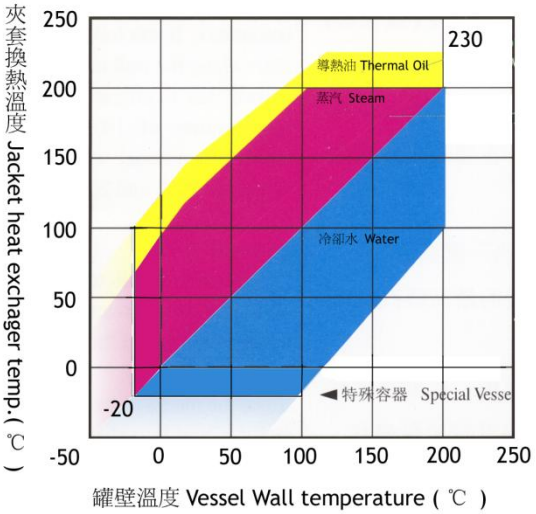


熱衝擊Thermalshock
釜內瓷面 on glass-lined side (Tp>Tw)
如：釜壁溫度為50℃時，不得加入溫度高於155℃的介質。Example: A vessel with a wall temperature of 50 ℃ should not be filled with a medium hotter than 155 ℃.

冷衝擊Coldshock
釜內瓷面 on glass-lined side (Tp<Tw)
如：釜壁溫度為160℃時，不得加入溫度低於55℃的介質Example: A vessel with a wall temperature of 160 ℃ should not be filled with a medium colder than 55 ℃.

搪玻璃設備夾套加熱與冷卻
Heating or cooling of a glass-lined unit

夾套加熱冷卻圖
Diagraph of Heating /Cooling in jacket



熱衝擊 Thermal shock
搪瓷鋼板面（加熱）Onmetal side (heating)
如：向壁溫（介質溫度）為50℃的夾套接入熱媒時，不得通入高於170℃的導熱油，或高於150℃的蒸汽。
Example: A heating medium applied to a vessel with a wall temperature (product temperature) of 50 ℃ should not be hotter than 170 ℃ (Thermal oil) , or 150 ℃ (steam).

冷衝擊 Cold shock
搪瓷鋼板面（冷卻）onmetal side (cooling)
如：當壁溫（介質溫度）為150℃時，不得向夾套通入低於45℃的冷媒。
Example: A cooling medium applied to a vessel with a wall temperature (product temperature) of 150 ℃ should not be colder than 45 ℃.

ACE Mender Pty Ltd
5/189 Union Road, North Albury
2640, NSW, Australia
Tel : +61 410 977 920
Email: kris_r@acemender.com
www.acemender.com

蘇州康銳思流體設備有限公司
江蘇省靖江城北工業園中心港中路1號
Tel : +86 523 8483 5955
Email: service@creas.cn
www.creas.cn