



# ***Stainless Steel Welding Consumables***

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R&D Department***

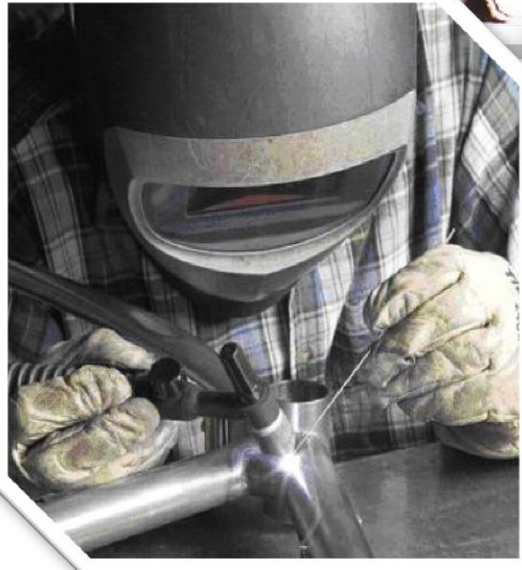
SMAW

GMAW

GTAW

FCAW

SAW



# 不锈钢简介

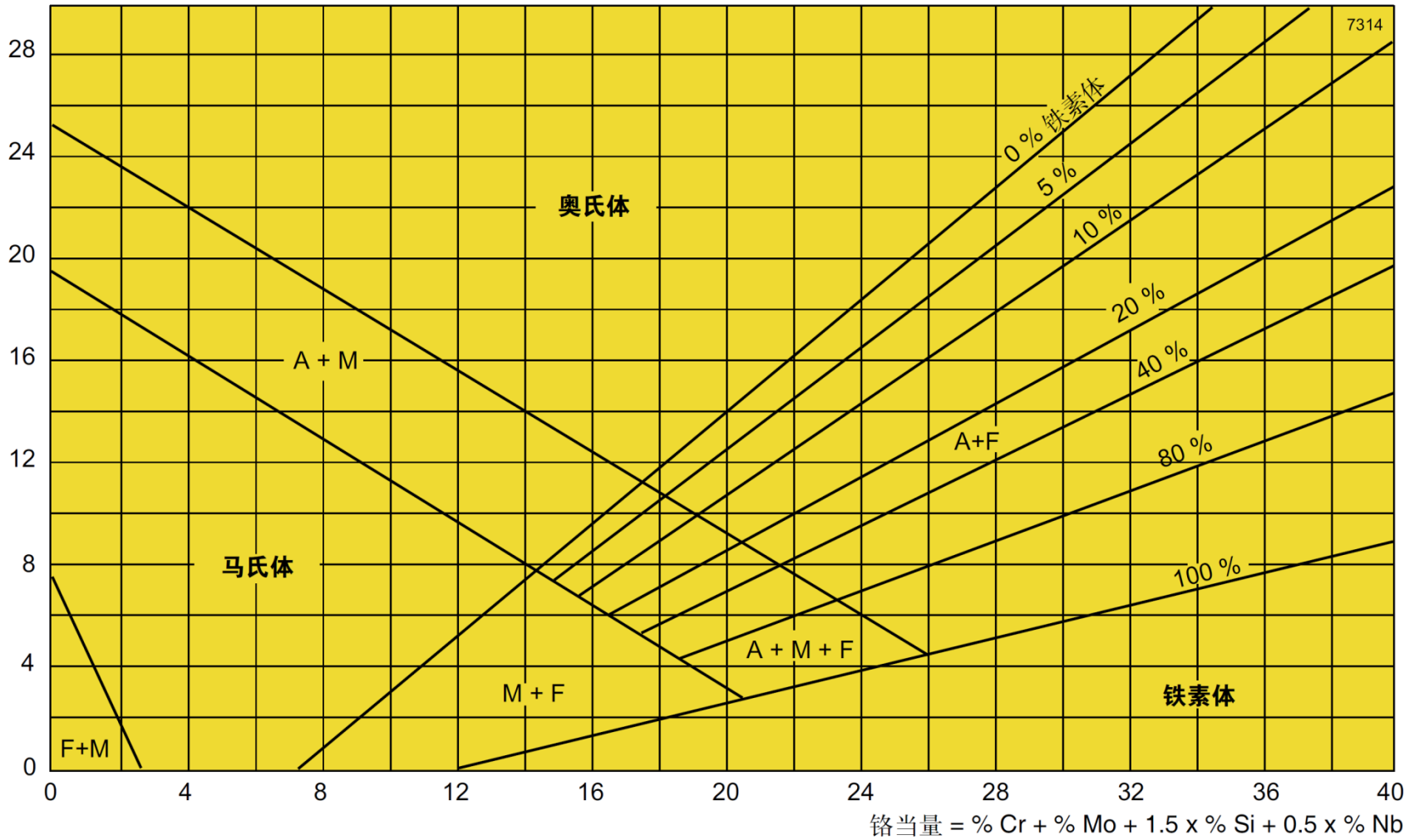
含有12%Cr以上的钢，耐空气、蒸汽、水等弱腐蚀介质或具有不锈性的钢种称为不锈钢，耐空气、蒸汽、水等弱腐蚀介质或具有不锈性的钢种称为不锈钢。

可分为:

- 1.马氏体钢
- 2.铁素体钢
- 3.奥氏体钢
- 4.奥氏体-铁素体（双相）不锈钢
- 5.沉淀硬化不锈钢

# Schaeffler图

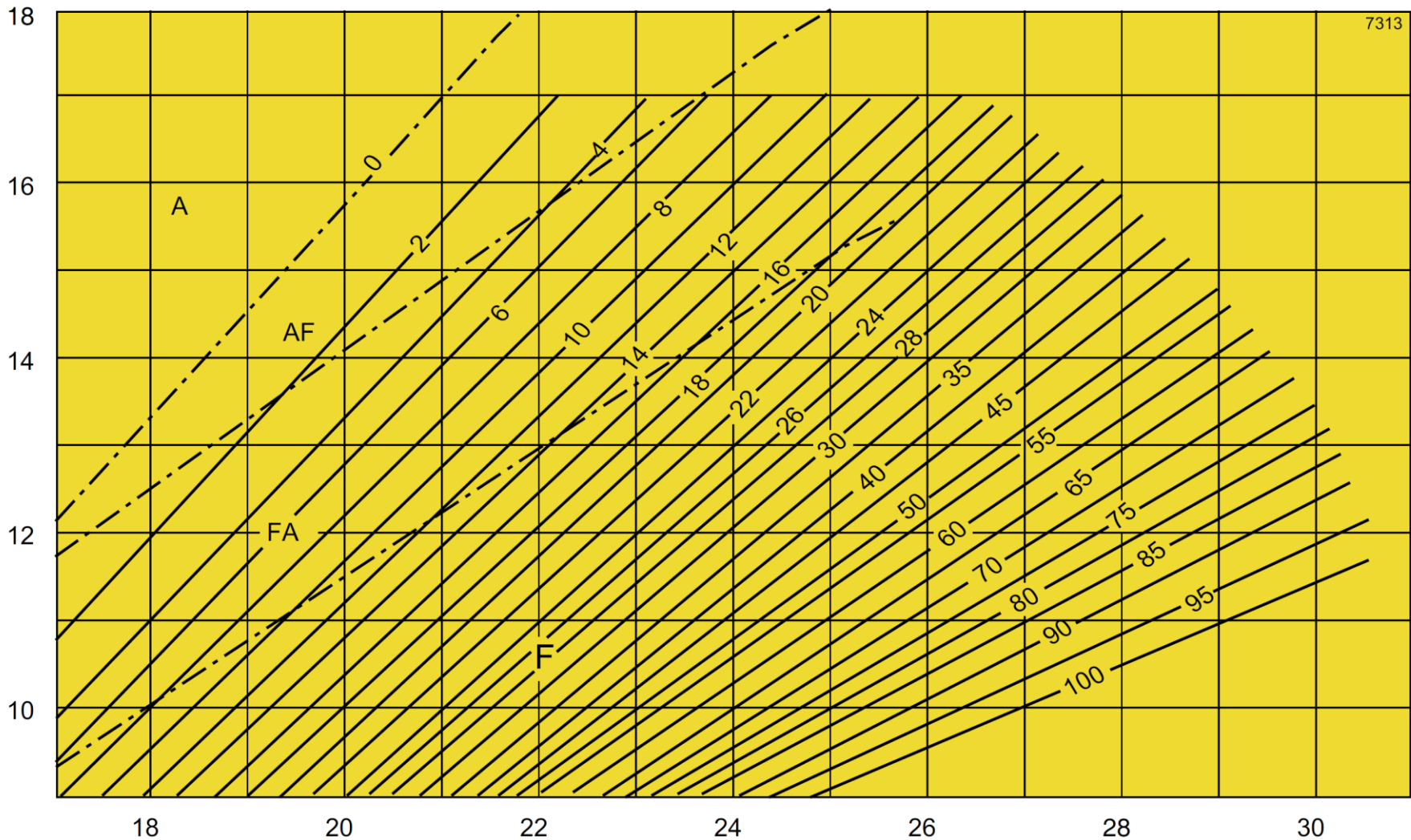
$$\text{镍当量} = \% \text{Ni} + 30 \times \% \text{C} + 0.5 \times \% \text{Mn}$$



组织与铁素体含量

# WRC图

$$\text{镍当量} = \% \text{Ni} + 35 \times \% \text{C} + 20 \times \% \text{N} + 0.25 \times \% \text{Cu}$$



凝固模式与铁素体含量

$$\text{铬当量} = \% \text{Cr} + \% \text{Mo} + 0.7 \times \% \text{Nb}$$

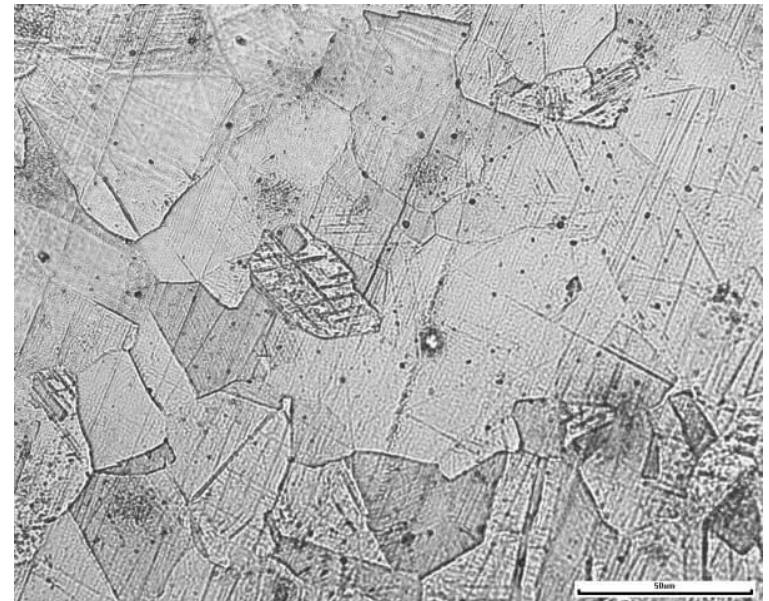


# 奥氏体系以302为基础 (18Cr-8Ni-0.15C)

- 减C→304耐酸
- 增Cr、Ni→309更耐蚀、耐热、耐氧化
- 加Mo、Ni→316、317耐孔蚀、增高温强度
- 加Nb、Ta→347、348耐晶界腐蚀
- 以Mn代Ni→202、204、205降低成本

## 代表焊材:

- 308L for 304
- 309L for 异材接合
- 316L for 316
- 347 for 晶间腐蚀
- 310 for 高温应用

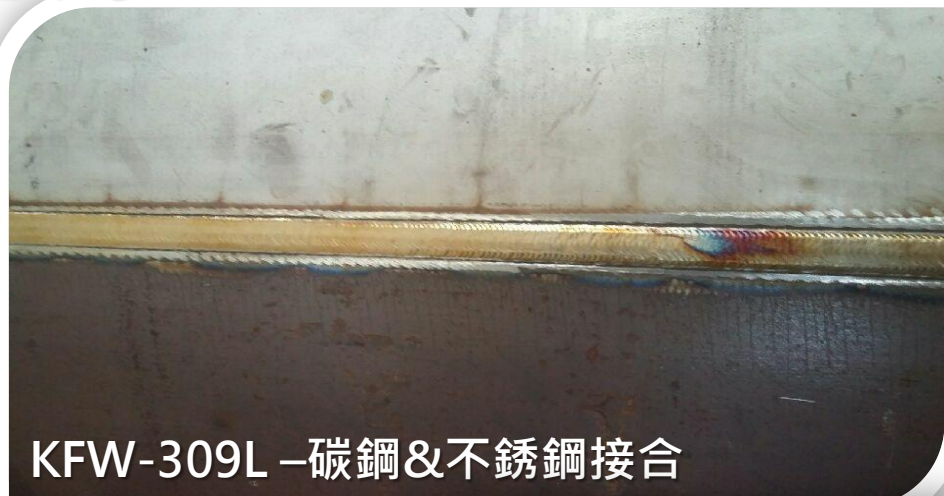


# 奧氏體不銹鋼各式應用

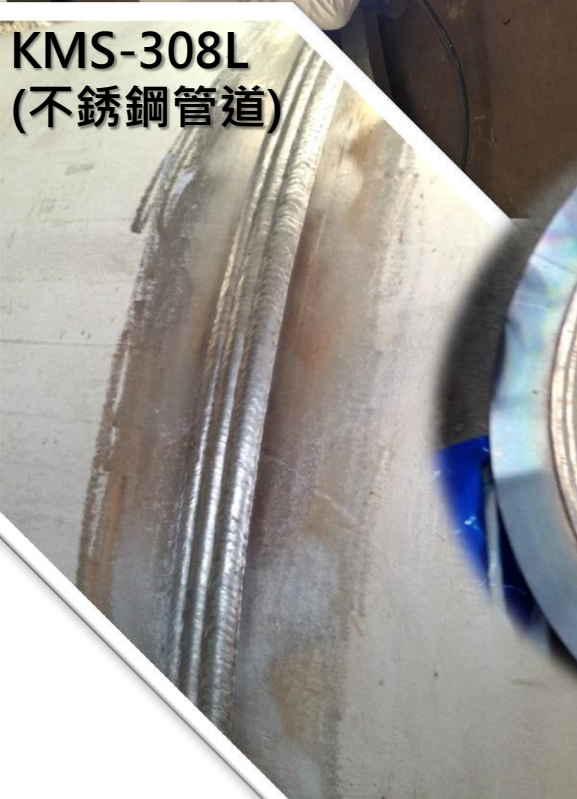
KFW-316L-法兰组裝



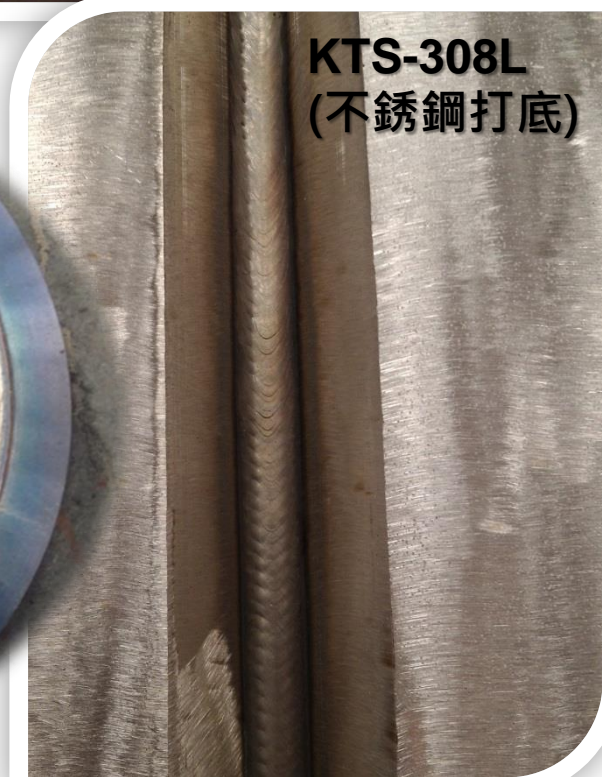
KFW-309L-碳鋼&不銹鋼接合



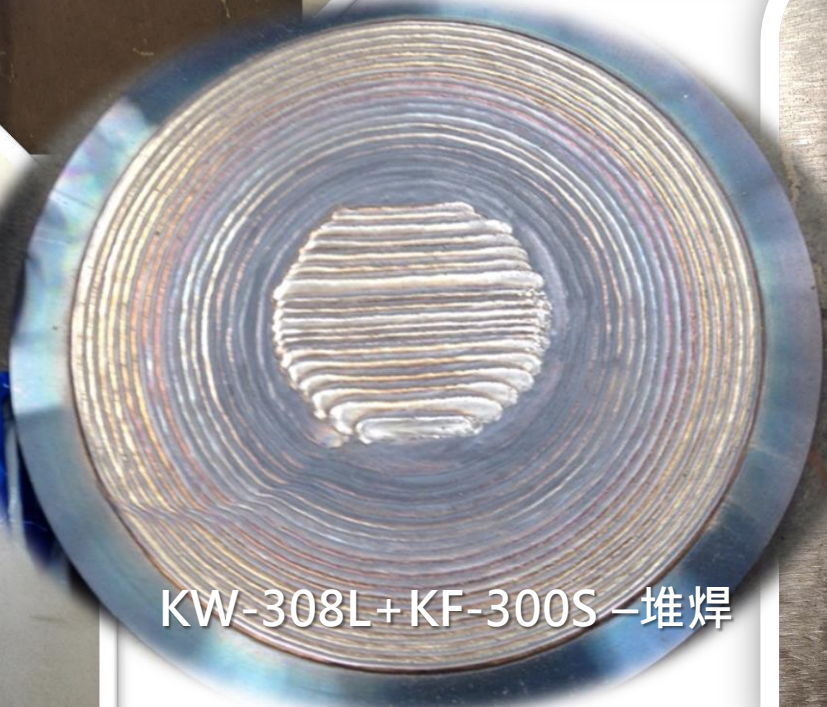
KMS-308L  
(不銹鋼管道)



KTS-308L  
(不銹鋼打底)



KW-308L+KF-300S-堆焊





# 測試實驗室(機械)試驗報告

TESTING LABORATORY (MECHANICAL PROPERTIES) TEST REPORT

報告編號(No.): MTT-131043

令編號(Job No.): L02SE000-1572



Testing Laboratory

0098

# 超低溫應用

- 降低C含量
- 優化Cr&Ni當量
- 調整FN值

委託者 (Applicant) : 廣泰金屬工業股份有限公司

地址 (Address) : 台南市官田區工業路20號

樣品名稱 (Sample Description) : GTAW銲接試片

工程名稱 (Project Description) : -

來樣日期 (Received Date) : 2013/05/03

簽發日期 (Issued Date) : 2013/05/03

取樣者 (Sampler) : -

測試項目 (Item) : 拉伸試驗; 衝擊試驗

使用設備 (Instrument) : UH-500KNI 萬能試驗機; SATEC 衝擊試驗機

測試方法 (Method) : AWS D1.1 規範

測試環境 (Ambient Temp.) : 25°C

測試結果 (Test Results) :

## 1. 拉伸試驗:

編號	試片截面積 mm <sup>2</sup>	抗拉強度 N/mm <sup>2</sup>	降伏強度 N/mm <sup>2</sup>	伸長率% (G. L. =50mm)
ER-308L 5/32x36"	93.3	606	459	36

## 2. 衝擊試驗:

編號	試片型式 (mm)V-notch	試驗溫度	吸收能 J (側膨脹mm)				
			66 (0.78)	60 (0.71)	90 (1.00)	71 (0.81)	58 (0.65)
ER-308L 5/32x36"	10x10x55	(-196°C)	66 (0.78)	60 (0.71)	90 (1.00)	71 (0.81)	58 (0.65)

- 以下空白 -

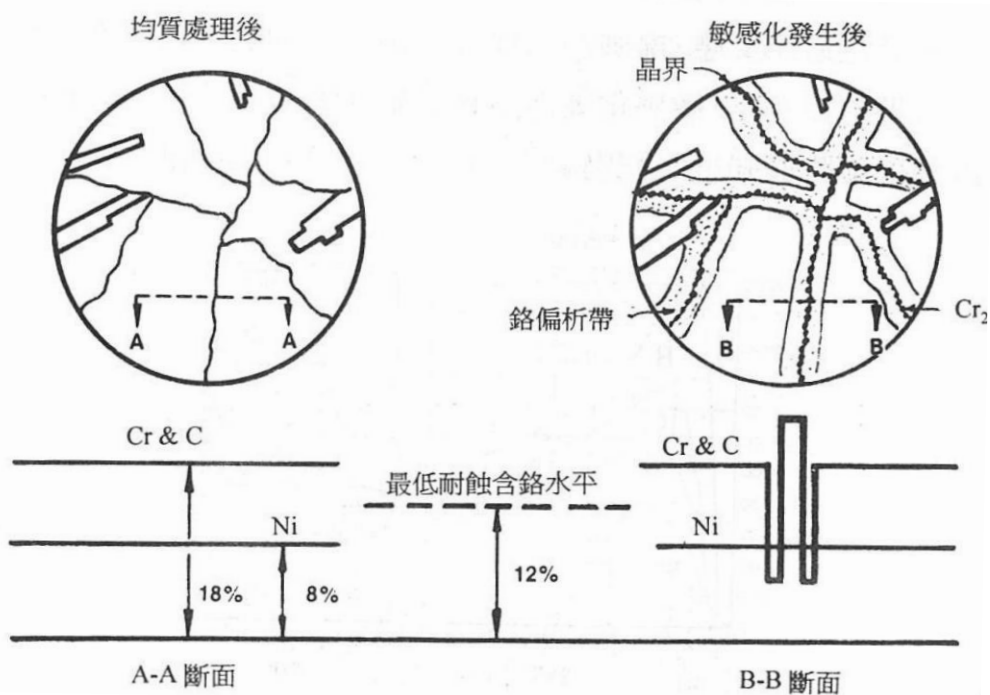
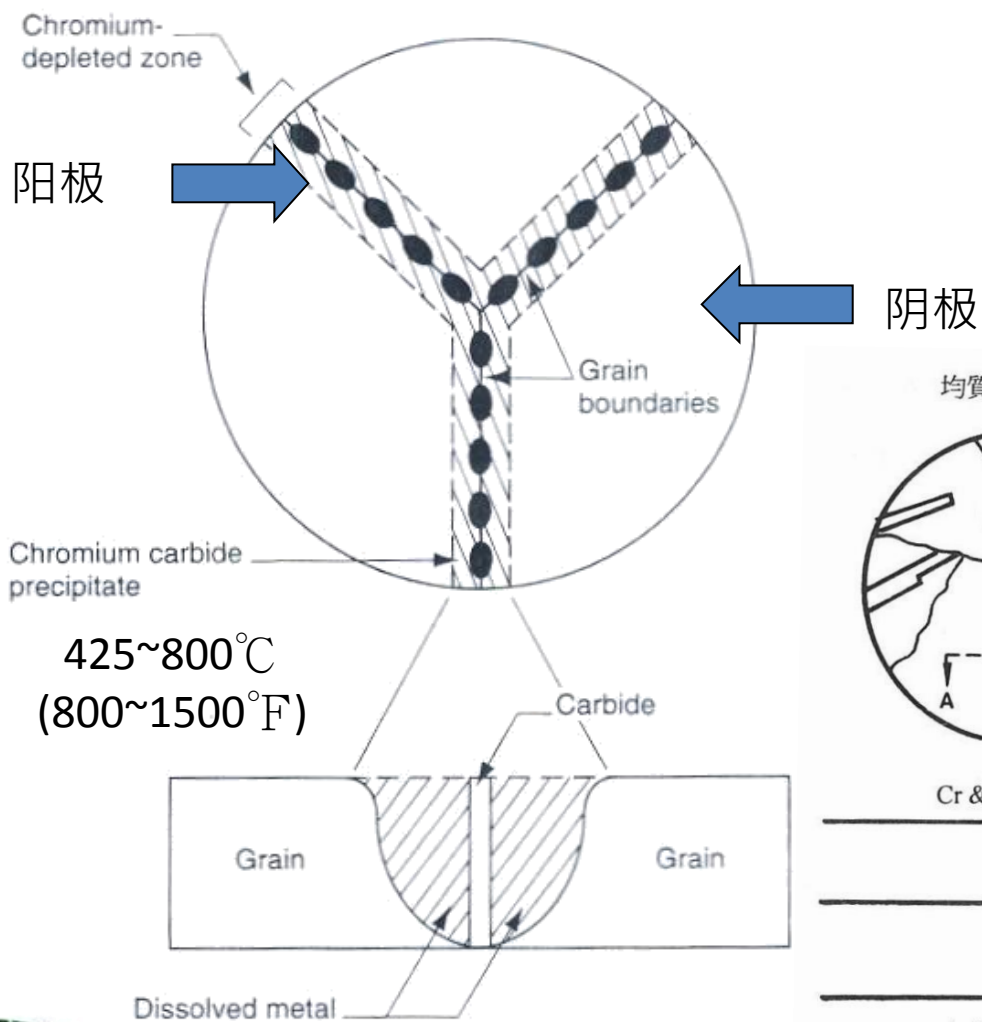


報告簽署人 (Report Authorized Person)



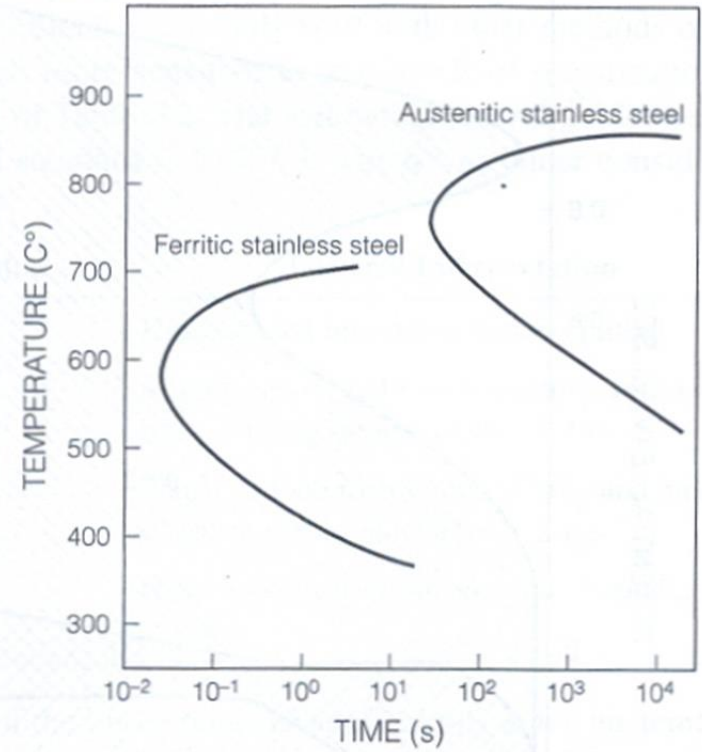
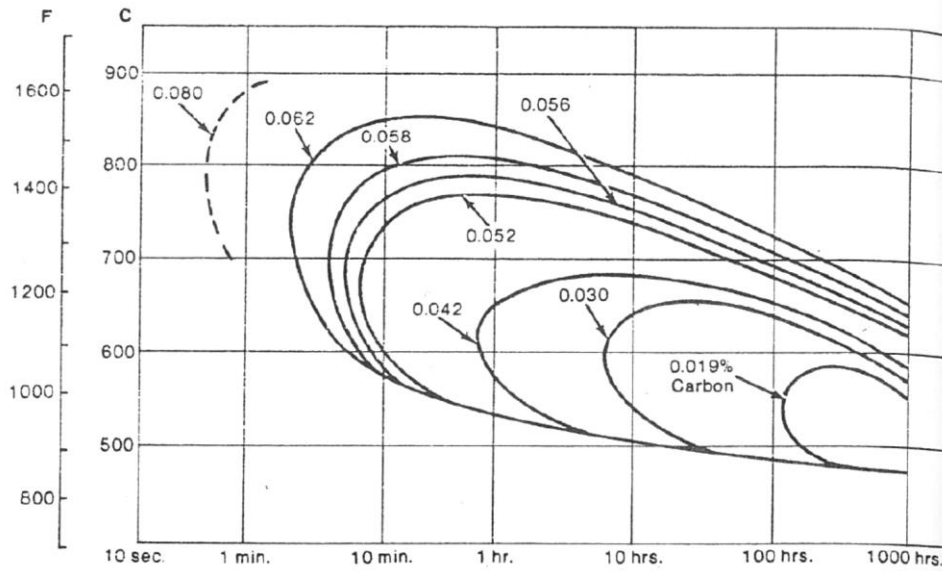


# 晶间腐蚀(敏化现象)



# 防止敏化現象對策

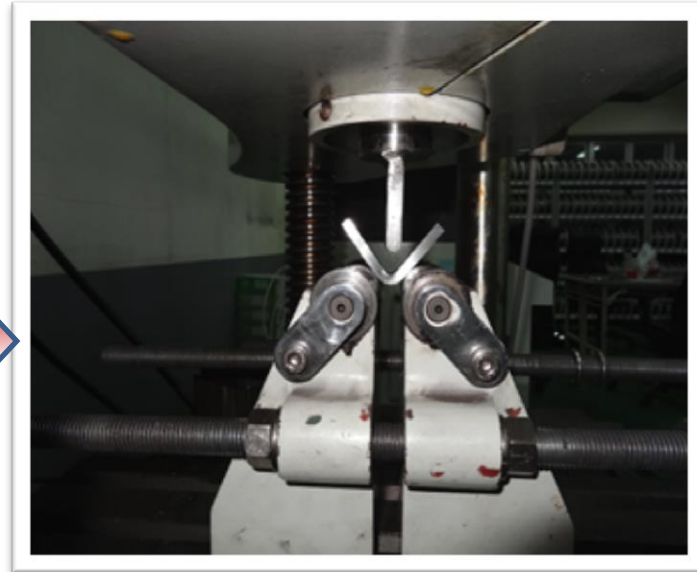
- 固溶化處理
- 降低C含量
- 添加Ti或Nb等穩定元素



# 晶间腐蚀(IGC)测试

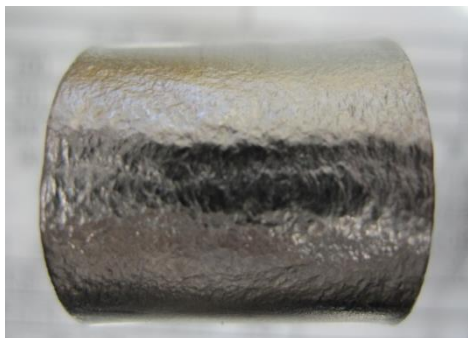


硫酸-硫酸铜腐蚀液  
24小时



规范: ASTM A262E

# 晶间腐蚀(IGC)测试结果

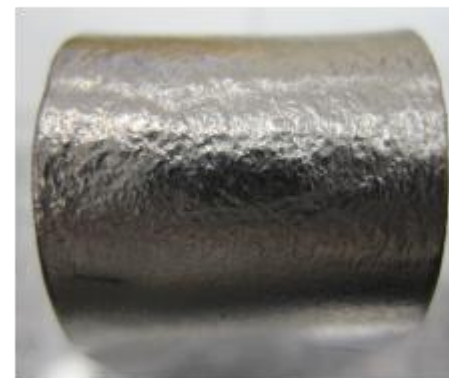


KS-308L (SMAW)



KMS-308L (MIG)

KTS-308L(TIG)



KFW-308L (FCAW)

# 焊接工艺性极佳之 不锈钢药芯焊丝



KFW-308L 1.2 mm  
200A 32V CO<sub>2</sub>  
Position: 2F

**廣泰金屬**  
KUANG TAI

**滿足您全方位銲接需求**  
SATISFY YOUR WELDING REQUIREMENT

## 不銹鋼包藥銲線系列

STAINLESS STEEL FLUX CORED WIRE



### 《產品特色》

- 作業性優異  
Good Weldability
- 銲道平滑美觀  
Smooth Bead Appearance
- 飛濺極少  
Less spatter
- 脫渣性極佳  
Excellent slag removal

品名	相當規格	
	ANS	
KFW-308L	E308LT1-1/4	E308LT0-1/4
KFW-309L	E309LT1-1/4	E309LT0-1/4
KFW-309LMo	E309LMoT1-1/4	E309LMoT0-1/4
KFW-316L	E316LT1-1/4	E316LT0-1/4
KFW-347P	E347LT1-1/4	
KFW-2209T	E2209LT0-1/4	



# 铁素体系以430为基础 (18Cr-0.12C)

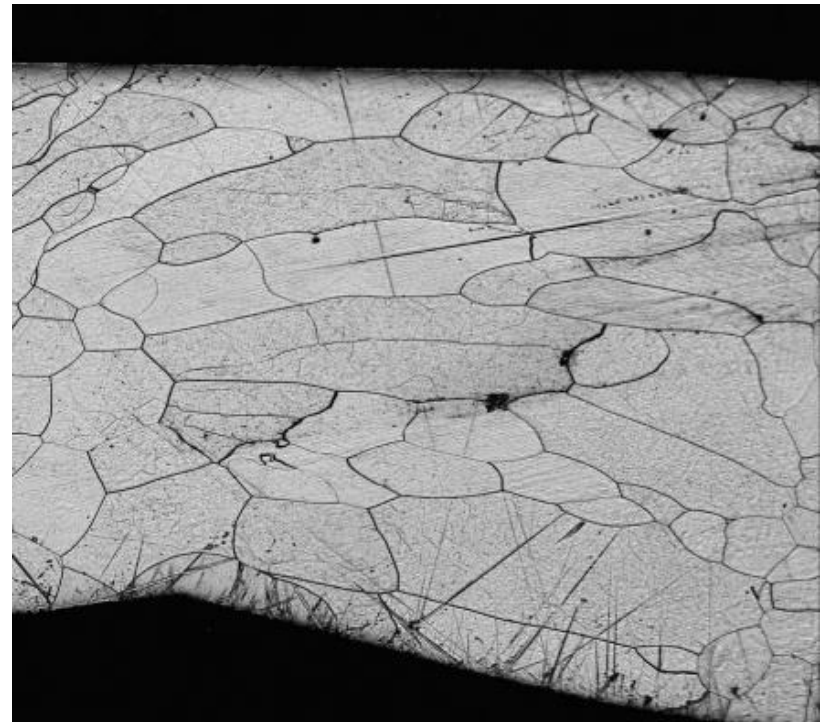
- 减Cr→429(16Cr) 耐酸
- 减Cr、增Ti→409(11Cr) 汽车排气管专用
- 增Ti→439(18Cr) 汽车排气管专用

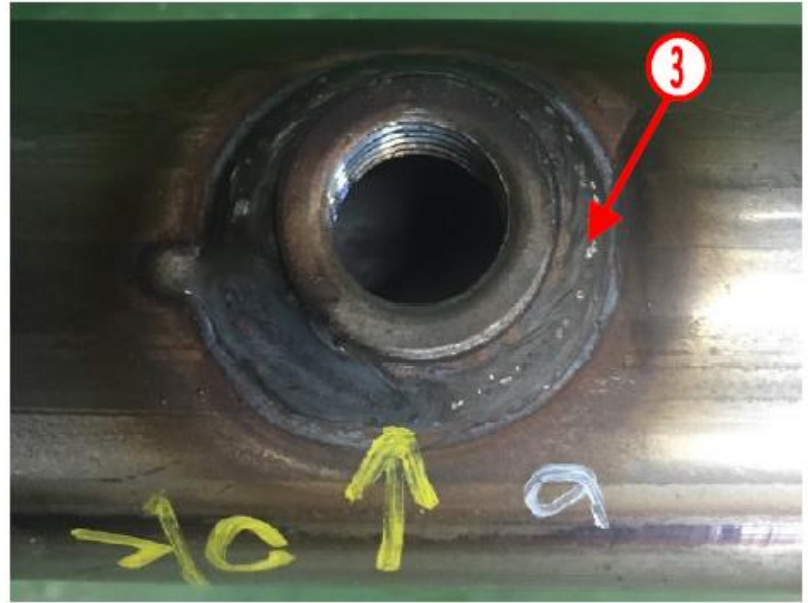
## 代表焊材:

- 409Ti
- 439Ti
- 430LNB

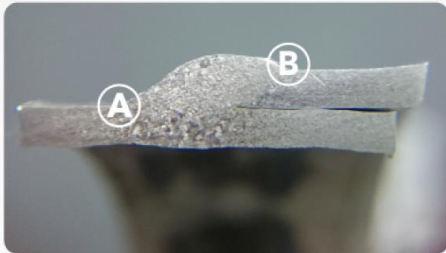


排气管





## KTM KMX 430LNB



### Welding Parameter

溶接条件  
焊接参数

Voltage 13V, Current 130A  
Travel Speed 50CPM

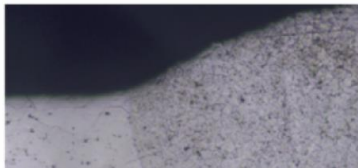
### Sample Etching Condition

腐食テスト条件  
試片腐蝕条件

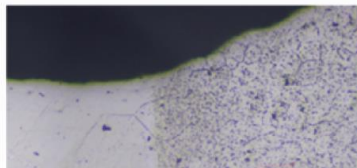
10g Oxalic acid + 100ml H<sub>2</sub>O  
2V, 90 secs, 31°C

### Position A

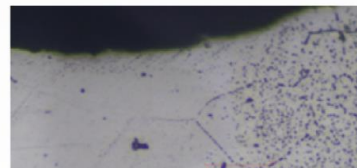
50X



100X

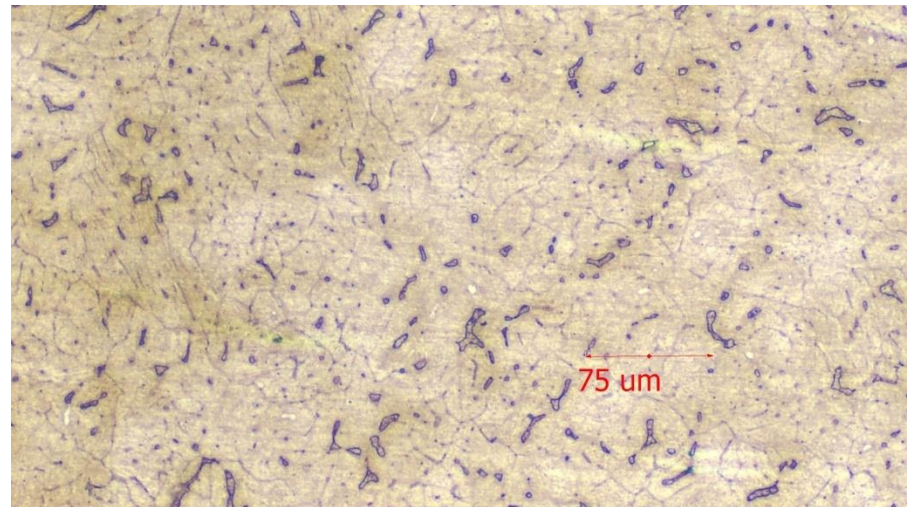


200X



# 马氏体系以420为基础 (13Cr-0.35C)

- 减C 410 (13Cr-0.15C)耐蚀、增韧性
- 减Si 403抗热
- 加Ni 414耐蚀、增韧性
- 加S 416提高切削性
- 加Cr、加C 440C (18Cr-1.2C)提高耐蚀性

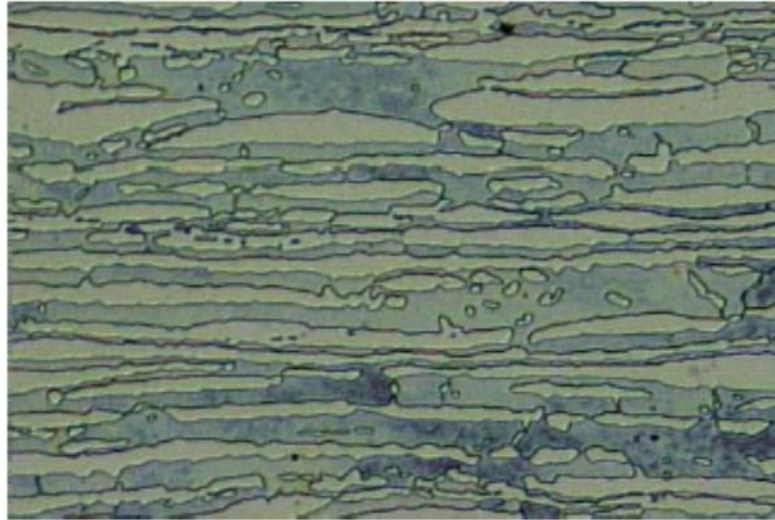






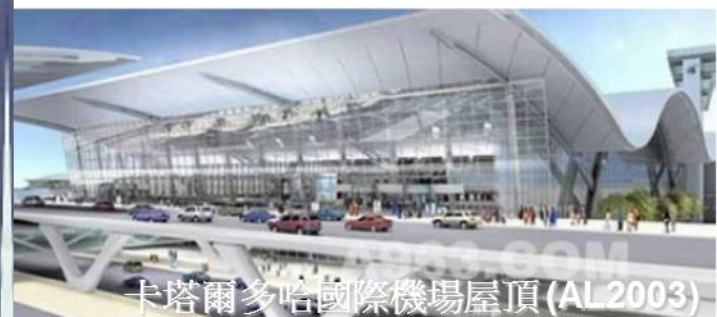
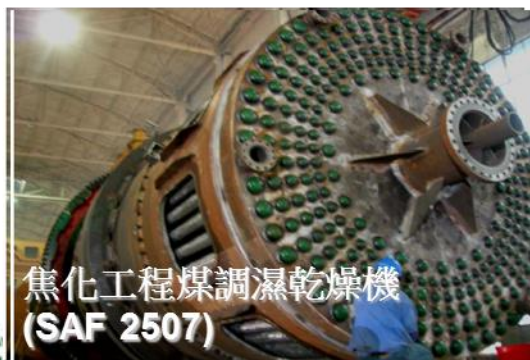
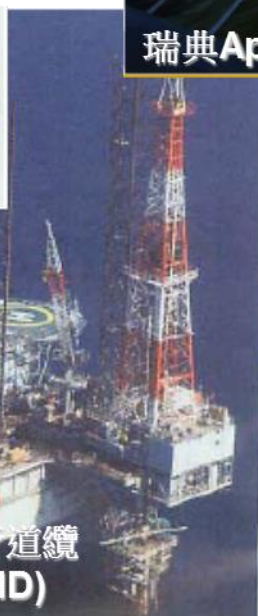
# 双相钢系以329为基础 (25Cr-4Ni-1.5Mo)

- 减Cr、加Ni→329JI
- 减Cr、C、加Mo→抗孔蚀与提高高温强度

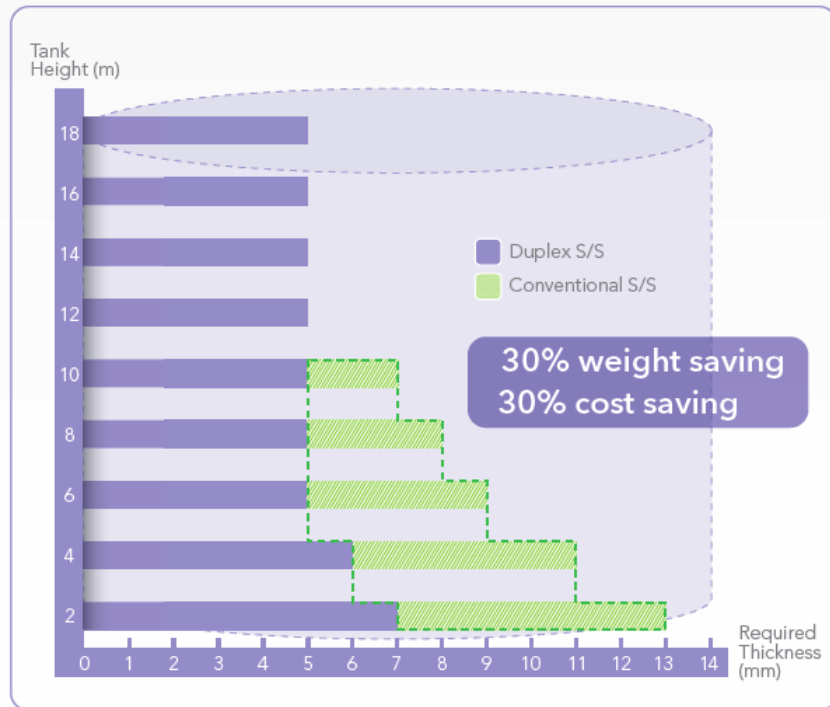
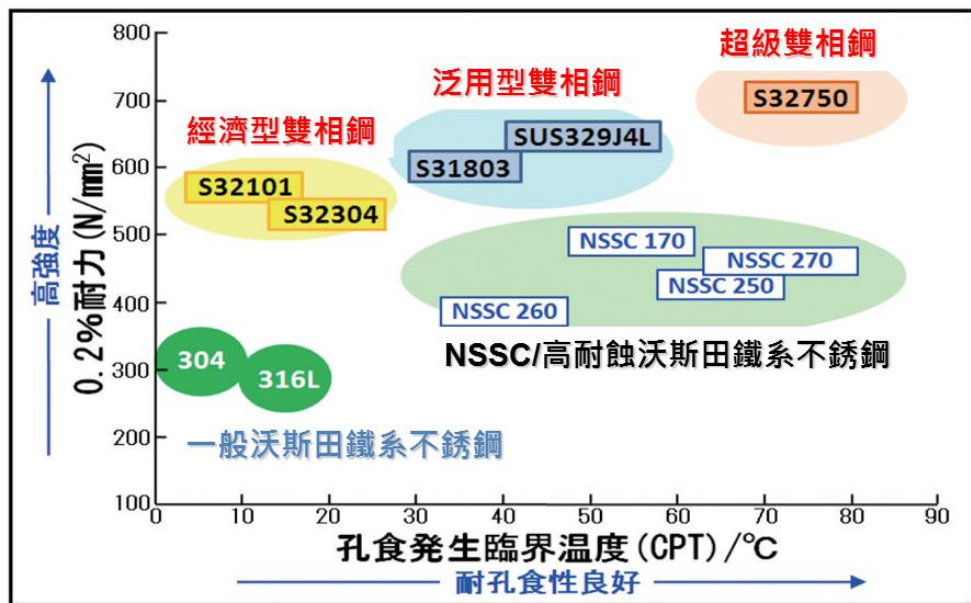
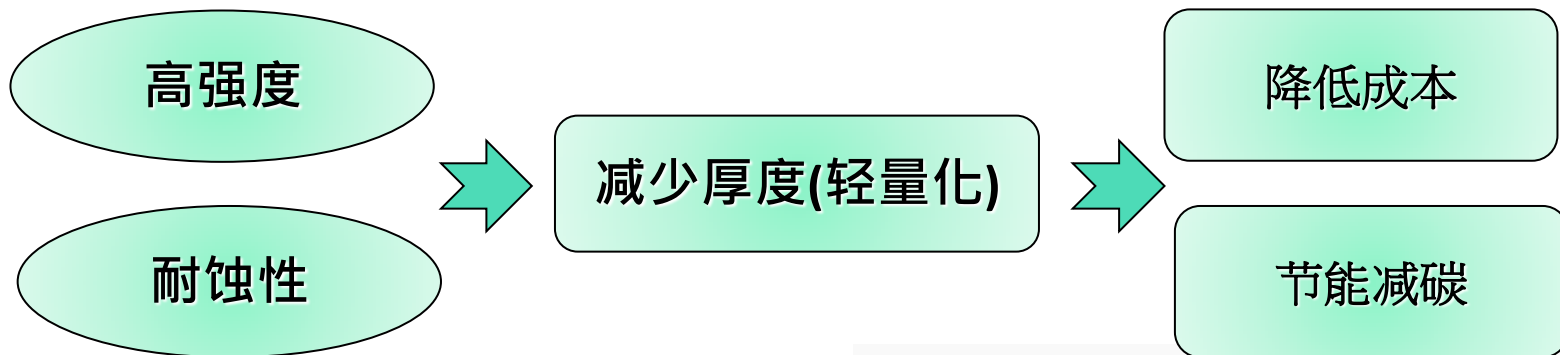


# 双相钢应用

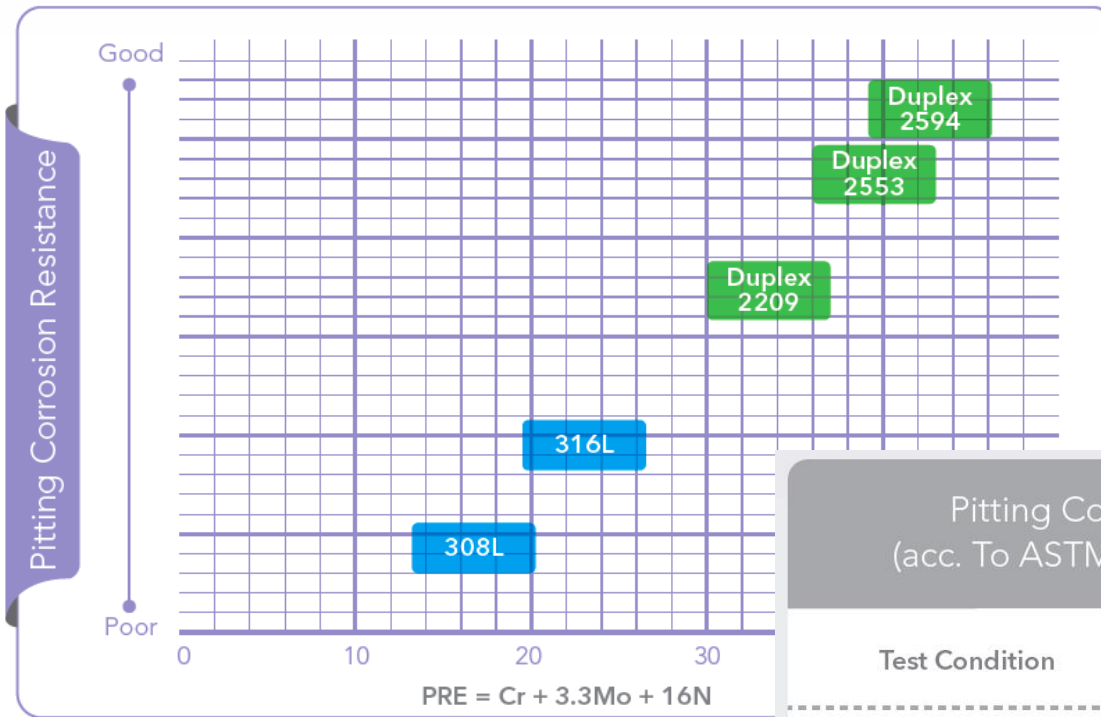
- 化学品船
- 建筑结构
  - 桥梁与混凝土钢筋
  - 建筑设施
- 深海油田
- 海水淡化
- 能源环保
  - 太阳能、核能
  - 废水废气处理设备



# 雙相鋼特性



# 双相钢的耐孔蚀能力



## Pitting Corrosion Test (acc. To ASTM G48 standard)

Test Condition

25°C / 72hr

Solution : 68.72g  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$  + 600ml  $\text{H}_2\text{O}$  + 16 ml HCl

Corrosion Weight Loss

0.0162 (g/  $\text{cm}^2$ )

Observation of Pitting

No Pitting

Sample : KFW-2209 (all weld metal)



Before Pitting Test



After Pitting Test

# 双相钢焊接工艺性能

## Weld Bead Appearance

Position	3F
Shielding gas	100% CO <sub>2</sub>
Current	150-160A
Voltage	25V

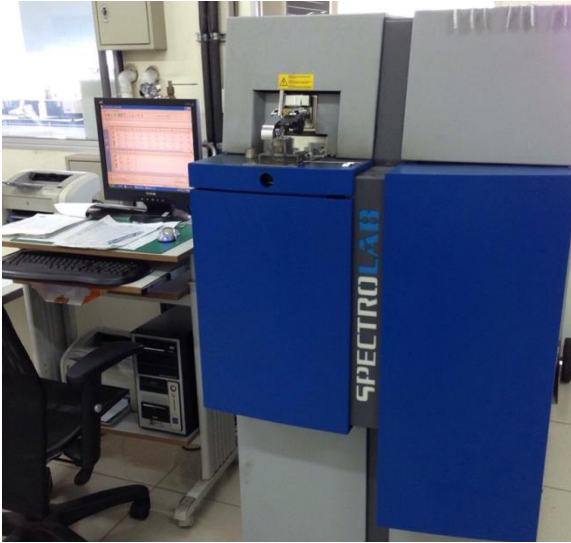
Sample : KFW-2209



# 双相钢焊材实绩

- 川东船厂
- 德盛船厂
- 平台船厂
- 东风船厂
- 厦门船厂
- 京雷科技
- 江源化工
- 九源机械
- 湘潭水泵厂
- 雷锋水泵厂
- 三洋造纸厂
- 三轮化机厂

# 广泰分析仪器



火花式分光仪



X光荧光分析仪



碳硫分析仪



氧氮分析仪



# 广泰分析仪器



万能试验机



冲击试验机



金相显微镜



铁素体测定仪

# 电焊条(Covered Electrode)

奥氏体	AWS
KS-307	A5.4/A5.4M E307-16
KS-308	A5.4/A5.4M E308-16
KS-308H	A5.4/A5.4M E308H-16
KS-308L	A5.4/A5.4M E308L-16
KS-308LT	A5.4/A5.4M E308L-16
KS-308EL	A5.4/A5.4M E308L-16
KS-309	A5.4/A5.4M E309-16
KS-309L	A5.4/A5.4M E309L-16
KS-309Mo	A5.4/A5.4M E309Mo-16
KS-309MoL	A5.4/A5.4M E309LMo-16
KS-347	A5.4/A5.4M E347-16

奥氏体	AWS
KS-310	A5.4/A5.4M E310-16
KS-310Mo	A5.4/A5.4M E310Mo-16
KS-310HC	A5.4/A5.4M E310H-16
KS-312	A5.4/A5.4M E312-16
KS-312BLUE	A5.4/A5.4M E312-16
KS-316	A5.4/A5.4M E316-16
KS-316L	A5.4/A5.4M E316L-16
KS-316ULC	A5.4/A5.4M E316L-16
KS-317	A5.4/A5.4M E317-16
KS-317L	A5.4/A5.4M E317L-16
KS-318	A5.4/A5.4M E318-16

马氏体/铁素体	AWS
KS-410	A5.4/A5.4M E410-16
KS-410NiMo	A5.4/A5.4M E410NiMo-16

双相钢	AWS
KS-2209	A5.4/A5.4M E2209-16
KS-2594	A5.4/A5.4M E2594-16



# 实心焊丝(MIG Wire)

奥氏体	AWS
KMS-307HM	-
KMS-307Si	-
KMS-308	A5.9/A5.9M ER308
KMS-308L	A5.9/A5.9M ER308L
KMS-308H	A5.9/A5.9M ER308H
KMS-308LSi	A5.9/A5.9M ER308LSi
KMS-309	A5.9/A5.9M ER309
KMS-309LMO	A5.9/A5.9M ER309LMO
KMS-309L	A5.9/A5.9M ER309L
KMS-309LSi	A5.9/A5.9M ER309LSi
KMS-310	A5.9/A5.9M ER310
KMS-312	A5.9/A5.9M ER312

马氏体/铁素体	AWS
KMS-409T1	A5.9/A5.9M ER409
KMS-409Cb	A5.9/A5.9M ER409Nb
KMS-410	A5.9/A5.9M ER410
KMS-420	A5.9/A5.9M ER420
KMS-430	A5.9/A5.9M ER430
KMS-430Nb	A5.9/A5.9M ER430
KMS-439T1	A5.9/A5.9M ER439

奥氏体	AWS
KMS-316	A5.9/A5.9M ER316
KMS-316L	A5.9/A5.9M ER316L
KMS-316H	A5.9/A5.9M ER316H
KMS-316LSi	A5.9/A5.9M ER316LSi
KMS-317	A5.9/A5.9M ER317
KMS-317L	A5.9/A5.9M ER317L
KMS-320	A5.9/A5.9M ER320
KMS-330	A5.9/A5.9M ER330
KMS-347	A5.9/A5.9M ER347
KMS-347H	A5.9/A5.9M ER347
KMS-347Si	A5.9/A5.9M ER347Si
KMS-385	A5.9/A5.9M ER385

沉淀硬化	AWS
KMS-630	A5.9/A5.9M ER630

双相钢	AWS
KMS-2209	A5.9/A5.9M ER2209
KMS-2594	A5.9/A5.9M ER2594



# 氩焊条 (TIG Rod)

奥氏体	AWS
KTS-307Si	-
KTS-307HM	-
KTS-308	A5.9/A5.9M ER308
KTS-308L	A5.9/A5.9M ER308L
KTS-308H	A5.9/A5.9M ER308H
KTS-308LSi	A5.9/A5.9M ER308LSi
KTS-309	A5.9/A5.9M ER309
KTS-309LMo	A5.9/A5.9M ER309LMo
KTS-309L	A5.9/A5.9M ER309L
KTS-309LSi	A5.9/A5.9M ER309LSi
KTS-310	A5.9/A5.9M ER310
KTS-312	A5.9/A5.9M ER312

马氏体/铁素体	AWS
KTS-409Ti	A5.9/A5.9M ER409
KTS-409Cb	A5.9/A5.9M ER409Cb
KTS-410	A5.9/A5.9M ER410
KTS-420	A5.9/A5.9M ER420
KTS-430	A5.9/A5.9M ER430
KTS-430Nb	A5.9/A5.9M ER430
KTS-439Ti	A5.9/A5.9M ER439

奥氏体	AWS
KTS-316	A5.9/A5.9M ER316
KTS-316L	A5.9/A5.9M ER316L
KTS-316H	A5.9/A5.9M ER316H
KTS-316LSi	A5.9/A5.9M ER316LSi
KTS-317	A5.9/A5.9M ER317
KTS-317L	A5.9/A5.9M ER317L
KTS-320	A5.9/A5.9M ER320
KTS-330	A5.9/A5.9M ER330
KTS-347	A5.9/A5.9M ER347
KTS-347H	A5.9/A5.9M ER347
KTS-347Si	A5.9/A5.9M ER347Si
KTS-385	A5.9/A5.9M ER385

沉淀硬化	AWS
KTS-630	A5.9/A5.9M ER630

双相钢	AWS
KTS-2209	A5.9/A5.9M ER2209
KTS-2594	A5.9/A5.9M ER2594



# 药芯焊丝 (Flux Cored Wire)

奥氏体	AWS
KFW-307	A5.22/A5.22M E307LT1-1/4
KFW-307F	A5.22/A5.22M E307T0-1/4
KFW-308L	A5.22/A5.22M E308LT1-1/4
KFW-308LF	A5.22/A5.22M E308LT0-1/4
KFW-308H	A5.22/A5.22M E308HT1-1/4
KFW-309L	A5.22/A5.22M E309LT1-1/4
KFW-309LF	A5.22/A5.22M E309LT0-1/4
KFW-309LMo	A5.22/A5.22M E309LMoT1-1/4
KFW-309LMoF	A5.22/A5.22M E309LMoT0-1/4
KFW-310	A5.22/A5.22M E310T1-1/4
KFW-316L	A5.22/A5.22M E316LT1-1/4
KFW-316LF	A5.22/A5.22M E316LT0-1/4
KFW-317L	A5.22/A5.22M E317LT1-1/4
KFW-317LF	A5.22/A5.22M E317T0-1/4
KFW-347	A5.22/A5.22M E347T1-1/4

铁素体	AWS
KMX-409Ti	A5.22/A5.22M EC409
KMX-439Ti	A5.22/A5.22M EC439
KMX-430LNb	-

双相钢	AWS
KFW-2209	A5.22/A5.22M E2209T1-1/4
KFW-2594	A5.22/A5.22M E2594T1-1/4



# 埋弧焊丝&焊剂 (SAW Consumables)

奥氏体	AWS
KW-308	A5.9/A5.9M ER308
KW-308L	A5.9/A5.9M ER308L
KW-309	A5.9/A5.9M ER309
KW-309L	A5.9/A5.9M ER309L
KW-309MoL	A5.9/A5.9M ER309LMo
KW-316	A5.9/A5.9M ER316
KW-316L	A5.9/A5.9M ER316L
KW-317L	A5.9/A5.9M ER317L
KW-347	A5.9/A5.9M ER347

马氏体	AWS
KW-410	A5.9/A5.9M ER410
KW-420	A5.9/A5.9M ER420

双相钢	AWS
KW-2209	A5.9/A5.9M ER2209
KW-2594	A5.9/A5.9M ER2594

焊剂	应用
KF-300S	适用一般奥氏体不锈钢
KF-810	适用马氏体不锈钢
KF-DP	适用347与双相钢





*Thanks for your attention!!*

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