

QPQ 盐及设备

经过 10 多年的潜心试验研究，开发成功了第二代 QPQ 技术——深层 QPQ 技术，其化合物厚度由原有 QPQ 技术的 15~20 微米增加到 30~40 微米以上。图 1 是 45 钢经普通 QPQ 技术处理和第二代 QPQ 技术处理后的金相照片。

After 10 years of experimental research, CTRI successful developed the second generation of QPQ technology - deep QPQ technology. The thickness of compound layer was increased from the original 15 ~ 20 microns to more than 30 ~ 40 microns. Picture 1 shows Metallographic photos for Deep QPQ treatment and general QPQ technology treatment.

已经进行了的耐磨性试验、抗蚀性试验、力学性能试验和渗层组织形态试验等的全面试验证明。由于工件经第二代 QPQ 处理后，其化合物层厚度成倍增加，工件各种性能均大幅度提高。

It has been proved by abrasion resistance test, corrosion test, mechanical property test and permeability layer microstructure test that component compound layer thickness is multiplied and work piece’s various performances are greatly improved after second generation QPQ treatment.

表 1 是 45 钢部分试验结果。

Table 1 shows part of test results for 45 Steel

耐磨性：45 钢经深层 QPQ 处理后滑动磨损实验耐磨性为普通 QPQ 处理的 4 倍，工件滚动磨损实验有相近的结果。

Wear resistance: sliding wear after deep QPQ treatment on 45 steel demonstrate that wear resistance is four times that of ordinary QPQ treatment. Work-piece rolling wear experiment shows similar results.

抗蚀性：45 钢经深层 QPQ 处理后失重实验抗蚀性为普通 QPQ 处理的 12 倍。在盐雾实验抗蚀性中抗蚀性为普通 QPQ 处理的 1 倍以上。如果深层 QPQ 技术与密封剂结合使用，盐雾试验抗蚀性可达 300h 以上，甚至更高。

Corrosion resistance: after deep QPQ treatment of 45 steel corrosion resistance of weightlessness experiment is 12 times increase compared to traditional QPQ treatment.

Corrosion resistance is more than 1 times higher. If combined with sealant, the corrosion resistance of salt spray test can reach more than 300 h or even higher.

冲击韧性：45 钢经深层 QPQ 处理后冲击韧性为普通 QPQ 处理的 1.98 倍。

Impact toughness: impact toughness after deep QPQ treatment on 45 steel is 1.98 times higher than ordinary QPQ treatment.

表 1 45 钢经深层 QPQ 与普通 QPQ 处理后性能比较表

处理方法	滑动磨损实验		失重抗蚀性实验		冲击韧性实验	
	磨损量/g	耐磨性比	失重量/g	抗蚀性比	冲击功/h	韧性比
QPQ 处理	0.538	1	20.99	1	12.2	1
深层 QPQ 处理	0.133	4.05	1.67	12.7	24.2	1.98

Table 1

Performance Comparison between Deep QPQ treatment and general QPQ technology treatment

Treatment Method	Sliding Wear Test	Weight-Loss Test	Impact Toughness Test
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	Wear /g	Wear resistance Ratio	weight lose /g	Corrosion Resistance Ratio	Impact Energy /h	Toughness Ratio
QPQ processing	0.538	1	20.99	1	12.2	1
Deep QPQ processing	0.133	4.05	1.67	12.7	24.2	1.98

QPQ 设备系列表

QPQ Equipment Series Table

设备型号	坩埚内尺寸	炉子外形尺寸	炉子功率	备注
300 型	Φ300×500	Φ900×900	15KW	随机配控制柜、热电偶和补偿导线
500 型	Φ500×700	Φ1200×1100	25KW	
800 型	Φ800×950	Φ1400×1400	50KW	
1000 型	Φ1000×1200	Φ1700×1600	75KW	
深型	Φ650×2500	Φ1350×3200	72KW	
特深型	Φ700×3250	Φ1400×3900	120KW	

Equipment model	Crucible Inside Size	Furnace Dimensions	Furnace Power	Remark
300 type	Φ300×500	Φ900×900	15KW	With control cabinet, thermocouple and compensating conductor
500 type	Φ500×700	Φ1200×1100	25KW	
800 type	Φ800×950	Φ1400×1400	50KW	
1000 type	Φ1000×1200	Φ1700×1600	75KW	
Deep type	Φ650×2500	Φ1350×3200	72KW	
Extra deep type	Φ700×3250	Φ1400×3900	120KW	

备注：可根据用户需求另行定制。

Remarks: Customized request is available

QPQ 盐浴复合处理专用盐系列表

QPQ salt bath composite processing special salt series table

类别	QPQ 技术专用盐	可选择种类	技术特点说明	备注
普通	基盐	粉状和块状	适用于大多数黑色金属材料，尤其对中碳钢、中碳合金钢等材料处理后提升效果显著，处理成本相对较低	块 状 是 指 进 行 过 初 步 熔 化 时 效 后 的 盐；氧化盐 吸 潮 后 局 部 会 出 现 块 状。
	调整盐	粉状		
	氧化盐	粉状		
第二代	第二代基盐	粉状和块状	适用于绝大数的黑色金属材料，尤其对高合金钢、不锈钢等材料处理后提升效果显著，渗层深度、渗层硬度、抗腐蚀性较普通处理有明显提升，处理成本相对较高。	
	第二代调整盐	粉状和块状		
	第二代氧化盐	粉状		
	气门专用高温盐	块状	使 用 温 度 在 540℃—570℃	
	气门专用低温盐	块状	使 用 温 度 在 525℃—535℃	

category	QPQ Special Salt	Options Available	Technical characteristics	Remarks
ordinary	Basic Salt	Powder and block	suitable for most ferrous metal materials, significant effect will be achieved especially for medium carbon steel, medium carbon alloy steel and other materials, and treatment cost is relatively low	Block refers to salt block that is caused by oxidation in salt moisture and the initial
	Adjusting Salt	powder		
	Oxide Salt	powder		
Second generation	Second Generation Basic Salt	Powder and block	Applicable to majority of ferrous materials, especially for high alloy steel, stainless steel and other materials. Effect will	
	second generation adjusting salt	Powder and block		
		powder		

			be enhanced significantly. Depth of nitride layer, layer hardness and resistance to corrosion will be improved compared to ordinary treatment.	melting of the salt
	High-temp Salt	chunks	Usage temperature 540℃—570℃	
	Low-temp Salt	chunks	Usage temperature 525℃—535℃	



第二代QPQ盐浴复合处理技术与装备

