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Praxair and TAFE TAFALOY® 45CT® Wire

Material Review:

45CT wire is a Nickel/Chrome/Titanium wire developed specifically for boiler applications. This second generation material replaces 06BXP and produces coatings which are extremely resistant to corrosive vanadium and sulfur gases in boiler atmospheres.

The material is prealloyed with titanium to produce superior bond strengths and is suitable for a one-coat system. The unusual self-bonding ability of the alloy is attributed to the exceptionally high temperatures of the metal particles which on impact with the base metal diffuse to form a partial metallurgical bond.

Metallurgical tests show negligible chrome loss during spraying. Coating porosities less than one percent are produced with negligible through porosity, thus maximizing the corrosion barrier characteristics of the material.

Application Review:

This material has proven very effective in providing long term protection to boiler tubes against high temperature sulfidation. The wrought material is highly resistant to sulfur/vanadium atmospheres up to 1800°F. Wrought material of this type has shown a 2 mil per year corrosion rate over a nine year period when used in the super heater section of boilers. Coatings of 45CT wire applied to boiler tubes have shown virtually no loss of thickness or spalling after 24 months of service (as of this writing).

Tests have shown the high chromium content, in conjunction with nickel, greatly improves the heat corrosion resistance of the alloy. Specifically, a chromium content of 40% or more is sufficient to form enough chromium oxide to prevent the breakdown of nickel into nickel sulfide which is not a protective layer. Sixty-four day accelerated corrosion tests of this material are highlighted in Figure 1. These tests were all run in the same test boat at the same time to assure identical environments. Specifically the specimens were surrounded with a synthetic smelt consisting of sodium chloride, sodium sulfate and sodium carbonate

The tests generally followed those of Dr. A. Plumley and R.G. Tallent of Combustion Engineering, Inc. Figure 1 is self-explanatory; both the plasma sprayed and multicoat materials deteriorated significantly in 35 to 40 days. Coatings made with 45CT wire on the other hand showed virtually no weight loss over the entire 64-day test. This superior corrosion resistance has been proven out in extensive on-line boiler tests.

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45CT wire has been metallurgically engineered to match closely the thermal expansion characteristics of boiler tube material. A178 low carbon steel is a typical boiler tube material which is commonly used.

Composition of A178

Carbon	0.06 - .18
Manganese	0.27 - .63
Phosphorus	0.050 max
Sulfur	0.060 max
Iron	Balance

Field experience in actual boilers (after over a year and a half as of this writing) has shown that this close match of coating and substrate is critical to preventing spalling of the coating. Figure 2 shows the final expansion rate of 45CT wire, A178 and a plasma applied iron base material.

The high deposit efficiencies achieved with this material coupled with significantly higher spray rates without coating deterioration contribute to application cost reduction.

Coatings of 45CT wire can be deposited up to feathered edges of the same material at a later date to extend the coating or repair or patch coatings mechanically damaged in service.

Composition:	
Titanium	0.3-1 percent
Chromium	42-46 percent
Other	0.5-1.85 percent
Nickel	Balance
Coating Physical Properties:	
Wire Size	1/16" (1.6 mm)
Deposit Efficiency	80-90 Percent*
Melting Point	2700°F(1482°C)(approx.)
Bond Strength	6,900 psi (48 MPa)
Tensile Strength	24,000 psi (165.5 Mpa)
Coating Texture	300-350 microinches aa
Microhardness	313 HKN ₁₀₀ (R _C 32)
Coating Porosity	Less than 1 percent
Coating Weight	0.37 lbs/ft ² /mil
Shrink	0.001 in/in (cm/cm)
Spraying:	
Spray Rate	11 lbs/hr/100 amps (5 kg/hr/100 amps)
Coverage (wire consumption)	0.8 oz/ft ² /0.001" (0.98 kg/m ² /100 micron)
Length of wire per lb	87 ft. (1/16")

* Up to 90 percent on large surface - Consult Factory

Spraying Procedure:

	8830	8850	9000 (No ArcJet Air)
Atomizing Gas Pressure	50	50	50
Nozzle Cap	Blue	Blue	Blue
Nozzle/Positioner (Cross = C, Slot = S)	Short C, S	Short C, S	Short C, S
Arc Load Volts	27-29	27-29	27-29
Amps	200-350	200-350	200-350
Standoff Inches (cm)	6-7 (17)	5-6 (15)	5-6 (15)
Coating Thickness/pass - mils (microns)	5 (125)	5 (125)	5 (125)
Coating Texture - microinches aa	Medium 300-350	Medium 300-350	Medium 300-350

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Finishing:

Coatings of 45CT wire are finished (if required) by machining or grinding. Machining gives a fair finish and grinding gives a good finish.

Hazards:

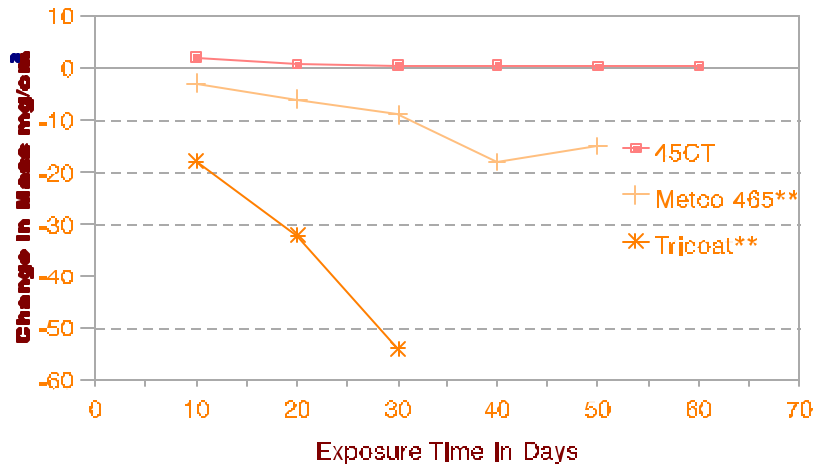
Chrome is under investigation in the welding industry as a toxic substance. Full respiratory protection should be used when spraying this material.

Observe normal spraying practices, respiratory protection and proper air flow pattern advised. See AWS Publication AWS C2.1-73, "Recommended Safe Practices For Thermal Spraying" on general spray practices and AWS TSS-85, "Thermal Spraying, Practice, Theory and Application". Thermal spraying is a completely safe process when performed in accordance with proper safety measures. Become familiar with local safety regulations before starting spray operations. DO NOT operate your spraying equipment or use the spray material supplied before you have thoroughly read the PRAXAIR and TAFE Instruction Manual.

DISREGARDING THESE INSTRUCTIONS MAY BE DANGEROUS TO YOUR HEALTH.

The information provided herein is believed to be accurate and reliable; however, results may vary with workpiece preparation and operator technique. PRAXAIR and TAFE warrants only that the wires are free of defects in material and workmanship. No other warranty is expressed or implied.

EXPOSURE OF VARIOUS BOILER COATINGS TO A SYNTHETIC BLRB SMELT AT 454 °C



** Test Halted Due to Coating Failure

Figure 1

COMPARISON OF EXPANSION RATES

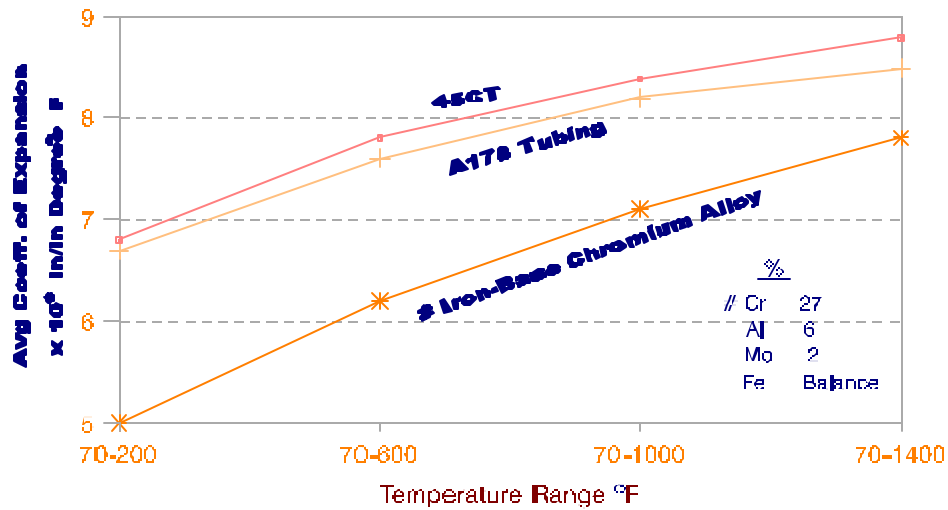


Figure 2



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