CeRam-Kote PCF and TZS

THE INTERNAL AND EXTERNAL COATINGS

Mechanical Properties Comparison

	CeRam-Kote PCF	CeRam-Kote TZS
Adhesion (ASTM 4541)	>2200 psi	>2200 psi
Pass Autoclave	Yes	Yes
Abrasion (ASTM D4060)	40.3 mg loss	27 mg loss
Impact Resistance (ASTM G14)	118 in. lbs.	90 in. lbs.
Static Coefficient of Friction	0.187	0.152
Distilled Water Immersion (ASTM D870-87) 122°F 149°F	 Pass Pass	 Pass Pass
Acid Immersion – 15% HCl in Distilled Water (by volume) for 24 hours at 122°F	Pass	Pass
Flexibility at 75°F (23.9°C)	1.05°/pd	2.1°/pd
Operating Temperature*	[redacted]	[redacted]

*Operating temperature is dependent on a number of variables including percentage of corrosive gases present. Please consult CeRam-Kote for well specific information.

INSTALLATION AND HANDLING PROCEDURES

Internally Coated Tubular

Introduction

You have just invested in a CeRam-Kote Coating System. Correct handling, installation, stimulation and wire line procedures must be followed to ensure maximum life from a coated tubing string. Otherwise, premature failure of coating can result.

Through years of service to customers, CeRam-Kote has compiled the following operating procedures when dealing with pipe protected by CeRam-Kote coatings. Following them will not increase your cost; however, it will help increase your return on a coating investment.

Inspection of Coated Tubular on Arrival

CeRam-Kote suggests the following inspection list be followed:

1) Upon arrival of the tubular goods, the load of coated tubular should be inspected for shifting or other potentially damaging movement.

2) Stripping should be placed between the pipe on the racks on which the pipe is to be stored.

3) Thread protectors should be in place and firmly installed on the threaded area.

Be Sure to Unload Coated Tubular Carefully

1) Please, do not attempt to pry or handle the pipe by inserting bars, etc. inside the pipe. This action could possibly damage the coating.

2) High-speed rolls and impacting should be avoided when unloading pipe. This could possibly damage the coating and / or the threads.

3) All tubing is shipped with a lead-free API modified thread compound applied to the threads. Should special thread compounds be required:

a) The protectors should be removed.
b) The threads should be cleaned and dried.
c) The special thread compound can then be applied.
d) The pin end thread protectors should then be reinstalled to protect the threaded area from possible damage while the pipe is elevated through the “V” door into the derrick.
e) If the pipe is placed in the stands of the derrick to await the running of the string, pin end protectors should be left in place and removed as each length is installed.
f) For more detail consult API RP 5C1, Section 2.9.

Use Stabbing Guides

A CeRam-Kote stabbing guide should always be used while running the tubular. This is to avoid damage to the coating on the pin end. The proper procedure for installation using the stabbing guide is shown below.

Open the guide and place over tubing collar.

Place pin end inside guide and make up the joint.

Open the guide and remove the guide.

Make-up Completely

CeRam-Kote recommends that API specifications be followed when making up. Please see page 23.

Use Protective Drift Bars

Often oil operators run drift bars or "rabbits" through the tube while elevating the pipe through the "V door". Should this be necessary, the drift bar should be made of wood, Nylatron, Teflon or any other material that would not inflict damage on the coated tube.

CeRam-Kote drifts each joint before it leaves our yard. We drift each joint by API specifications on thin-mil coatings. For a table on Bare Drift sizes and Coated Drifts, please see page 22.

Clearly Identify Wells Which Contain Coated Tubular

All wells with coated tubing should be identified so that everyone is aware that the well is equipped with coated tubing. Experience has shown that the majority of damage done to coated tubing is done before anyone realizes they are working on a coated string.

Use Protective Pressure Testing Tools

Whenever pressure testing of the made up joint is desired, pressure-testing tools should be selected which will not damage the internal protective coating. Most pressure testing firms have such equipment available.

Stimulate Wells with Caution

Well stimulation must be done with caution. Prolonged exposure to mud acid or super mud acid can result in severe damage to the coating. The greater the bottom hole temperature of the well, the more rapidly this damage will occur.

The acids used in well stimulation and work over operations attack the mineral components in all coatings. This attack is slow but irreversible. Therefore, acid attack on a coating is cumulative, i.e., if the coating life is 40 hours at 140°F (60°C) in mud acid and it is exposed for 20 hours, 50% of its life in this acid is used up. If it is exposed at a later date to mud acid at 140°F (60°C), we would not expect the full life of 40 hours, but rather 20 hours. The engineer should keep track of the exposure of his coatings to acid environments and express these exposures in terms of total coating life remaining with regard to acid resistance.

It is important to remember that during normal acidizing operations, the acid is charged into the formation so quickly it rarely arrives at bottom hole temperature. Cool acid has relatively little effect on coatings. However, when trouble is encountered or for any other reason the acid is held in the string long enough to have reached zone temperature, then acid contact time should be noted. All CeRam-Kote coatings have sufficient acid resistance to maintain corrosion protection after normal acidizing operations. Consultation with a CeRam-Kote representative is recommended when acidizing is anticipated.

Run Wire Lines Carefully

When it becomes necessary to do wire line work, good judgment should be used in the selection of tools that are used. When running the tools, it is necessary that the speed be controlled with very rigid supervision. A stiff line should be maintained going in the hole with weight on the indicator at all times. Keep speed constant and under operator control at all times. Any wire line work should be at reduced speeds (100 feet per minute or less). If caliper surveys are necessary, it is more advantageous to utilize old wheel-type feelers or ball pointed feelers. ***Knurled drive wheels should not be used.*** All kick over tools should be run with extreme care. It is recommended that a centering spring type device with rubber coating over the inserts be used. The inserts and springs should be covered with rubber or surgical hose for added protection. Do not run tubing end locators in coated tubing. If it is necessary to fish wire lines, a wire locator should be the only tool run. Knuckle joints or knuckle jars should not be run in coated tubing. Rope sockets, sinker bars, stabilizers and stems should have all wrench marks filed smooth and be coated if possible. CeRam-Kote coating "Patch Kits" are available and can be applied in the field. No paraffin removal devices should be run in coated tubing. Tubing stops that are magnetically set or mandrel set are recommended. Removable collar stops, tubing stops or tubing set mandrels should not be used. Under no circumstances should drilling jars be used. Only hydraulic or tubing jars should be run when necessary.

All wrenches, slips, elevators and tongs should be in good condition. The use of 360° full grip tongs is encouraged. Swabbing should be performed with a slick line, coated tools and an all rubber, wing type swab cup. No wire reinforced swab cups should be used.

When Pulling Tubing, Use Tubing Tools in Good Condition, Stack Carefully, and Be Sure To Protect Pin Ends.

When it becomes necessary to remove a tubing string from the well, it is important that you select the best tools (slips, power tongs, back up tongs, and elevators) that are available to do the job. CeRam-Kote recommends "SLIP GRIP" elevators and 360° back-up tongs with a minimum of 85% contact area.

If the tubing to be pulled will set in stands in the derrick, a resilient pad should be used on the rig floor to protect the coated end of the tubing. If such a pad is not available, thread protectors should be installed prior to setting the joint of tubing on the rig floor. It is also suggested that the thread protector be installed on the pin end if the tubing is laid down through the "V door."

Utilize float trailers rather than pole trailers. Impacting the thin wall pipe cannot be tolerated. The use of bridled end hooks, pinch bars or any other tools that might damage the protective film should be avoided. Instructions should be furnished to the carrier to check and keep tight boom chains.

Coated Drift Sizes

Size (O.D.)	Weight per Foot	Bare Drift	Coated Drift (Ceram-Kote Drift Sizes)
2-1/16"	3.25		1.645
2-3/8"	4.70	1.901	1.881
	5.95	1.867	1.847
2-7/8"	6.50	2.347	2.327
	8.70	2.165	2.145
3½"	9.3	2.867	2.847
	12.95	2.625	2.605
4½"	12.60	3.833	3.813
	12.75		

Recommended Tubing Makeup Torque (API RP 5C1)

			Torque, ft-lb		
Size (O.D.)	Weight per Foot	Grade	Minimum	Optimum	Maximum
2-1/16"	3.25	H-40	430	570	710
2-1/16"	**3.25**	**J-55**	**560**	**740**	**920**
2-1/16"	3.25	C-75	730	970	1210
2-1/16"	3.25	L-80	760	1010	1260
2-1/16"	3.25	N-80	770	1030	1290
2-1/16"	3.25	C-90	820	1100	1370
2-3/8"	4.70	H-40	740	990	1240
2-3/8"	**4.70**	**J-55**	**970**	**1290**	**1610**
2-3/8"	4.70	C-75	1590	2120	2650
2-3/8"	**4.70**	**L-80**	**1320**	**1760**	**2200**
2-3/8"	**4.70**	**N-80**	**1350**	**1800**	**2250**
2-3/8"	4.70	C-90	1440	1920	2410
2-3/8"	4.70	P-105	2120	2830	3540
2-3/8"	5.95	C-75	1590	2120	2650
2-3/8"	5.95	L-80	1640	2190	2740
2-3/8"	5.95	N-80	1680	2240	2800
2-3/8"	5.95	C-90	1800	2390	2990
2-3/8"	5.95	P-105	2120	2830	3540
2-7/8"	6.50	H-40	940	1250	1560
2-7/8"	**6.50**	**J-55**	**1240**	**1650**	**2060**
2-7/8"	6.50	C-75	1630	2170	2710
2-7/8"	**6.50**	**L-80**	**1690**	**2250**	**2810**
2-7/8"	**6.50**	**N-80**	**1730**	**2300**	**2880**
2-7/8"	6.50	C-90	1850	2460	3080
2-7/8"	6.50	P-105	2180	2910	3640
2-7/8"	7.90	C-75	1960	2610	3270
2-7/8"	7.90	L-80	2030	2710	3390
2-7/8"	7.90	N-80	2080	2770	3470
2-7/8"	7.90	C-90	2230	2970	3710
2-7/8"	7.90	P-105	2630	3500	4380
2-7/8"	8.70	C-75	2140	2850	3560
2-7/8"	8.70	L-80	2210	2950	3690
2-7/8"	8.70	N-80	2270	3020	3780
2-7/8"	8.70	C-90	2420	3230	4040
2-7/8"	8.70	P-105	2860	3810	4760
3½"	9.3	H-40	1300	1730	2160
3½"	**9.3**	**J-55**	**1710**	**2280**	**2850**
3½"	9.3	C-75	2260	3010	3760
3½"	**9.3**	**L-80**	**2350**	**3130**	**3910**
3½"	**9.3**	**N-80**	**2400**	**3200**	**4000**
3½"	9.3	C-90	2570	3430	4290
3½"	9.3	P-105	3040	4050	5060
3½"	12.95	C-75	3030	4040	5050
3½"	12.95	L-80	3150	4200	5250
3½"	12.95	N-80	3220	4290	5360
3½"	12.95	C-90	3450	4610	5760
3½"	12.95	P-105	4070	5430	6790

QUESTIONS AND ANSWERS

The following questions and answers deal primarily with the use of CeRam-Kote coatings on Oil Country Tubular Goods for the Oil Industry.

1. **How does CeRam-Kote perform on used pipe?**

   Liquid, spray-applied CeRam-Kote polymer coatings flow into pits, depressions and holes. The thin-film application of CeRam-Kote of 10 - 15 mils (275-375 microns) provides holiday-free coverage on used pipe. Other conventional pipe coatings (both liquid thin-film epoxy phenolics and fusion bonded powder epoxies) have considerable difficulty in achieving holiday-free coverage on the rough metal surfaces typically found in used pipe.

   CERAM-KOTE COATINGS INCORPORATED does not recommend CeRam-Kote for down-hole service on any tubing graded less than yellow band (0-15%) wall loss. CERAM-KOTE COATINGS INCORPORATED does not recommend CeRam-Kote for any service on any pipe graded less than blue band (16-30%) wall loss.

2. **What is reverse impact? Does reverse impact affect CeRam-Kote?**

   Reverse impact physically deforms a coated object (pipe, Q-Panel, etc.) from the uncoated side, (i.e., coat one side of a Q-Panel with CeRam-Kote, then strike the sample from the uncoated side and observe the reverse impact damage on the coated side). This process may stretch the metal beyond its yield point, and/or bend the metal beyond its ability to hold its original form. If the metal is deformed beyond its yield point, reverse impact may cause CeRam-Kote to craze or crack.

3. **Are there any special handling requirements for CeRam-Kote coated tubular goods?**

   Any coated tubing should be handled with care to prevent unnecessary damage to pipe, during both transport and installation. CeRam-Kote will survive normal handling conditions in well servicing and pipe installations. CeRam-Kote recommends the use of stabbing guides for all pipe installations.

   Special care should be taken when making-up or breaking-out tubing. Do not over-torque tongs past API specs. This may cause “reverse impact” damage to coating. Thin-wall tubing is especially susceptible (2 1/16” and 2 3/8” OD).

4. What are other oil field applications for CeRam-Kote coatings?

Anywhere there are corrosion or abrasion problems, CeRam-Kote products may be used to extend the useful life of equipment. A few oil field applications for CeRam-Kote are listed below:

- Tubulars
- Pup joints, couplings, subs and cross-overs
- Pumps, valves and valve parts
- Tanks and vessels
- Manifolds
- Flow lines, fabricated pipe and fittings
- Fire tubes and heater treaters

5. Is CeRam-Kote suitable for drill pipe protection?

Drill pipe requires a tough, flexible, corrosion resistant, scale resistant, abrasion resistant and chemical resistant coating system. CeRam-Kote's performance characteristics include resistance to wire-line and tool damage. CeRam-Kote out-performs other conventional liquid or powder drill pipe coatings.

CeRam-Kote, due to its dense surface, effectively prevents the build-up of normally occurring radioactive material (N.O.R.M.) on drill pipe which can occur during the drilling process. If N.O.R.M. builds up on the inside of drill pipe, it must be removed and disposed of as hazardous material.

6. What sizes, weights and grades of pipe are effectively coated at the Big Spring facility?

CERAM-KOTE's Big Spring Pipe Coating Facility can internally coat pipe of all grades. The Big Spring facility can internally coat 2" to 12", up to Range III (45 ft.) lengths.

Larger pipe, such as manifolds and headers can be coated in CERAM-KOTE's custom shop, also located in the Big Spring facility. Please contact a CERAM-KOTE representative with specific requirements.

7. What are the differences in White, Yellow, Blue, Green and Red band pipe?

White band	=	Class 1 : 0 body-wall loss (Like-new pipe)
Yellow band	=	Class 2 : 0 - 15% body-wall reduction (85% minimum remaining)
Blue band	=	Class 3 : 16 - 30% body-wall reduction (70% minimum remaining)
Green band	=	Class 4 : 31 - 50% body-wall reduction (50% minimum remaining)
Red band	=	Class 5 : 50% + body-wall reduction (less than 50% remaining)

One red band highlights defects detected on the pin or box end (thread and/or coupling damage).

One green band appears on each side of restriction.

One green band applied next to the body-wall indicates a drift restriction.

8. How are pipe threads protected during the coating process?

Pipe threads are protected with plastic or composite protectors. Premium threaded tubing and casing require special protectors made in accordance with the manufacturer's specifications.

9. What part of the 8RD coupling is coated?

The J-section of the coupling or one (1) inch in each direction from the centerline is coated.

10. How is pipe externally coated?

Pipe to be coated externally with CeRam-Kote is blasted to a NACE-1 (white metal), no less than NACE-2 (near white metal) finish with a 2 - 2 ½ mils anchor profile. An air-sprayed application using conventional spray equipment is applied in two passes to achieve a 10 - 15 mil (275-375 micron) coating thickness. The coating application is performed inside a closed facility.

11. What procedure does CERAM-KOTE COATINGS INCORPORATED recommend when stimulation fluids are charged through CeRam-Kote coated tubing?

If the well fluids are not hot and stimulation fluids are charged through the coated tubing in a short period of time, there is generally little effect if the fluids are flushed completely through the tubular.

However, some organic acids and solvents may have a detrimental effect on certain organic coating systems, especially as temperatures increase. If stimulation fluids are left in the tubing, they can reach formation temperature and cause accelerated attack on the coating. A CERAM-KOTE representative should be consulted prior to stimulation.

12. What does oxygen do downhole in an injection or disposal well to coated tubing?

Oxygen is not found downhole unless it is introduced from the surface. Oxygen can enter the system in several ways, (i.e., a seal leaking on a triplex pump, hatches left open on storage tanks, leaving a valve open on the backside of tubing). Some operators believe having an oil column above the produced water in a tank will block oxygen. Independent testing by a major oil company has proven it will not. All openings to a tank must be closed and a nitrogen blanket applied to the tank to prevent oxygen from entering the system.

13. How does CeRam-Kote react to paraffin?

Initially, paraffin moves up the well bore in solution. As it passes through cooling zones in the formation, it reaches its cloud-point and falls out of solution as a solid. The smooth dense surface of CeRam-Kote does not allow paraffin to build-up as readily as it does on some coatings and bare pipe.

14. What is the acid resistance of CeRam-Kote?

As a general rule, CERAM-KOTE COATINGS INCORPORATED does not recommend the use of CeRam-Kote in acid environments unless the temperature is ambient (72°F [22.2°C]) or below.

15. Does CeRam-Kote lose flexibility down-hole?

In sour crude (H_2S) and higher temperature environments, CeRam-Kote post-cures and loses some flexibility. With normal aging, CeRam-Kote experiences reduced flexibility; however, enough flexibility remains so that CeRam-Kote is one of the most impact resistant, corrosion and abrasion resistant high performance coatings available.

16. Can CeRam-Kote prevent blast joint failures in a rod pumping well?

Absolutely. Many customers use CeRam-Kote in this problem area. CeRam-Kote lined tubing in conjunction with a composite top ring installed on the insert pump has given operators extended run times without tubing failure.

We've got coated pipe ready to roll, with supply partners across the country, and a support staff of **experts** as knowledgeable as CeRam-Kote is tough.

We work hard to get you back to work as quickly as possible.

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