

An Economic Evaluation of the Wear of Hard Metal Coated Surfaces
presented at IRG-OECD, Tama-shi, Oct. 27,1995

Donald G. Bellow
University of Alberta
Edmonton, Alberta, CANADA

*An Economic Evaluation of the
Wear of Hard Metal Coated
Surfaces*

by
Donald G. Bellow
Professor of Mechanical Engineering
University of Alberta

&
Gaby H. Sonego
Quality Assurance Manager
Black Max Downhole Tool Ltd.
Niaka, Alberta

Purpose of Research

- ◆ To evaluate the wear of hard metal coated couplings when subjected to sliding abrasive wear.
- ◆ To provide an economic assessment of the coated couplings with an uncoated coupling.

Materials Evaluated

- ◆ Hard metal coatings evaluated were; Titanium Oxide, Nickel Chromium and Nickel Tungsten..
- ◆ These were compared with uncoated couplings made from AISI 8630 steel.

Experimental Conditions

- ◆ Sliding wear apparatus used oil field sucker rod couplings (50mm dia. x 100mm long) sliding against J-55 oilwell tubing (0.06-0.1C, 1.1-1.3Mn, 0.33-0.47Co, 0.015-0.125Ti).
- ◆ Fluid medium was a sand and water mixture.
- ◆ Wear was caused by a reciprocating action along a wear track of 0.44m, 18m/min.

Experimental Measurements

- ◆ Sand was dispensed at a rate of 165g/day.
- ◆ Coupling wear was measured by weight loss and tubing wear was measured by reduction in wall thickness.
- ◆ Wear measurements were conducted at 10,000, 100,000, 200,000. and 300,000 m of travel.

*Wear Results for Couplings
(water with no sand)*

	NiCr Rc58	NiW Rc75	TiO2 Rc57	8630 VH190
wt. loss grams	0.8	0.6	0.63	2.47
loss wrt 8630	0.32	0.24	0.26	1.00
wear resist.	3.09	4.12	3.92	1.00

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Wear Results for Couplings (water with sand)

	NiCr Rc58	NiW Rc75	TiO2 Rc57	8630 VH190
wt. loss grams loss wrt 8630 wear resist.	9.7	10.3	28.2	31.4
	0.31	0.33	0.90	1.00
	3.24	3.05	1.11	1.00

Observations on Coupling Wear (water, no sand)

- ◆ NiCr, NiW and TiO2 surfaces were 3-4 times more resistant to wear than standard AISI 8630 uncoated surface.

Observations on Coupling Wear (water with sand)

- ◆ The NiCr and NiW coated couplings were more than three times resistant to wear than the uncoated AISI 8630 coupling.
- ◆ At higher loads (not shown) the TiO2 coating quickly broke down in the presence of a sand water environment.

Wear Results for J-55 Tubing (water, no sand)

	NiCr Rc58	NiW Rc75	TiO2 Rc57	8630 VH190
thick. loss mm	0.06	0.05	0.09	0.10
thick. loss wrt 8630 wear resist.	0.06	0.50	0.90	1.00
	1.67	2.00	1.11	1.00

Observations on Tubing Wear (water, no sand)

- ◆ The NiW coated coupling caused the least amount of wear to the tubing, followed by the NiCr and TiO2 coated couplings.

Tubing Wear (water with sand)

	NiCr Rc58	NiW Rc75	TiO2 Rc57	8630 VH190
thick. loss mm	0.46	0.71	0.52	0.76
thick. loss wrt 8630 wear resist.	0.61	0.93	0.68	1.00
	1.65	1.07	1.46	1.00

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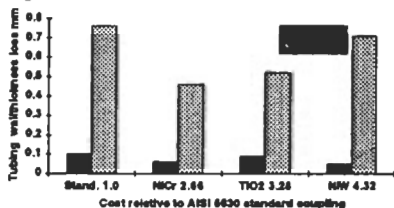
Observations on Tubing Wear
(water with sand)

- ◆ The NiCr coating caused the least amount of wear to the J-55 tubing, followed closely by the TiO₂ coated coupling.
- ◆ The NiW coated coupling caused about the same amount of wear as the uncoated AISI 8630 coupling.

Estimated Costs of Coated Couplings

cost\$/ coup. powd. appl. base total wrt stand.	NiCr	NiW	TiO ₂	8630
	3.71	14.98	9.76	0
	7.50	7.50	5.63	0
	6.75	6.75	6.75	6.75
	17.96	29.23	22.14	6.75
	2.66	4.32	3.28	1.00

Cost Benefit to J-55 Tubing



Cost Benefit to Coupling

