Эксплуатационные свойства бурильных труб из алюминиевого сплава Д16 с защитными покрытиями

Operation properties of drill pipes made of coated aluminum alloy 2024

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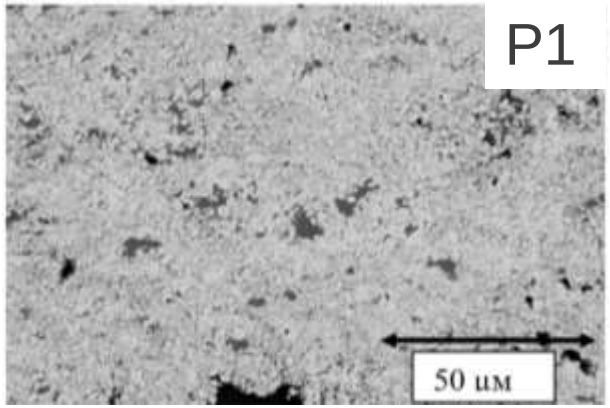
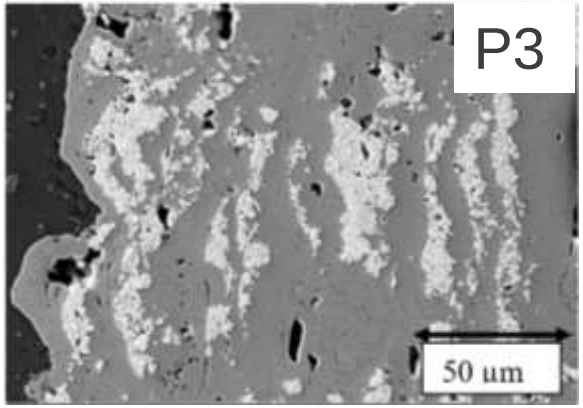
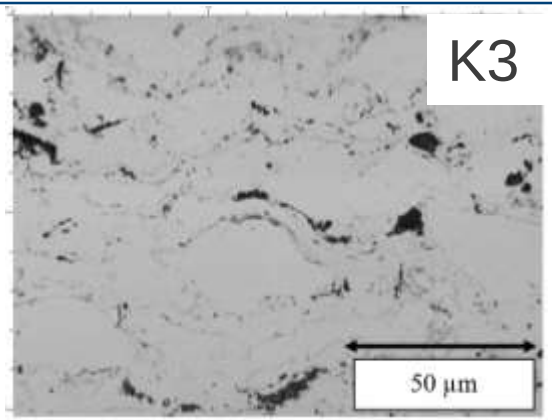
Main advantages of aluminum alloys

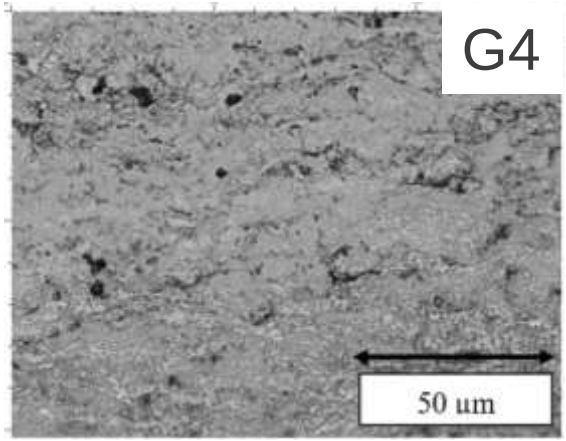
- **Specific weight**
- **Specific strength**
- **Lack of cold brittleness**
- **Lack of hydrogen embrittleme**
- **Corrosion resistance**

Metallography analysis of coatings



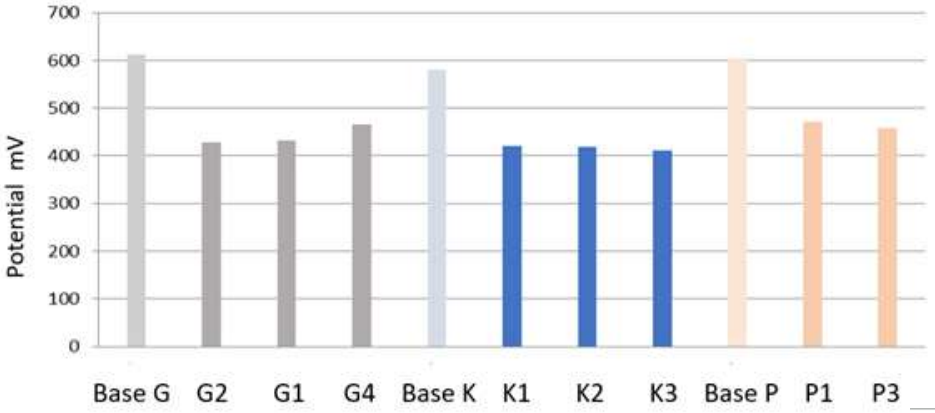


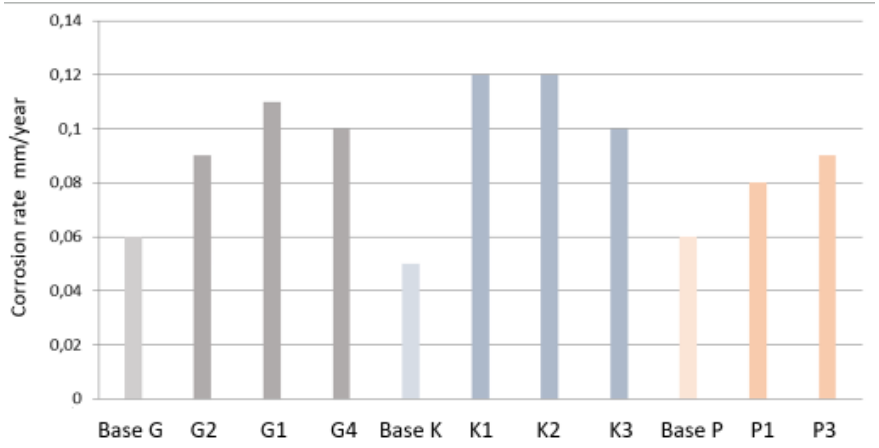




Coating title	Coating composition	Structural homogenity	Porosity, %	Microhardness, HV, Pa
P 1	WC	+	1.94	11300
P 3	WC Ni-Cr-Si	-	3.25	12000 8700
K 1	WC	+	0.04	12300
K 2	WC Ni-Cr-Si	-	0.03	12000 8700
K 3	Ni-Cr-Si	-	4.45	6300
G 1	WC Ni-Cr-Ni-Mo	+	0.54	11600 5500
G 2	Fe-Cr-Ni	+	0.08	7900
G 4	WC	+	0.76	12900

Influence of coating on corrosion properties aluminum alloy





Estimate of adhesion and wear resistance

Coating	Maximum breaking stress level of the coated area, MPa
P1	1000
P3	800
G1	1040
G2	1040
G4	1000
K1	1020
K2	980
K3	1020

Coating	Marking	Weight loss, g	Test period, min
P1	P1.1	2.4	240
	P1.2	0	480
	P1.3	0.3	480
P3	P3.1	6.2	120
	P3.2	8.7	480
	P3.3	6.9	480
G1	G1.1	0.2	30
	G1.2	0.7	30
G2	G2.1	12.5	30
	G2.2	19.5	30
G4	G4.1	0	480
	G4.2	0	480
	G4.3	0	480
K1	K1.1	0.1	480
	K1.2	0	480
	K1.3	0	480
K2	K2.1	31.5	30
	K2.2	10.6	30
	K2.3	9.8	30
K3	K3.1	2.2	480
	K3.2	2.2	480
	K3.3	2.2	480

Conclusion

Coating	Corrosion resistance	Stress-related properties	Wear-resisting properties	Total
P1	9	9	8	26
P3	9	8	5	22
G1	9	10	1	20
G2	9	10	1	20
G4	9	9	10	28
K1	9	9	9	27
K2	9	8	1	18
K3	9	9	7	25

All the coatings examined increase the properties of aluminum drill pipes, but the effectiveness of the influence depends on their composition and structure. The corrosion and mechanical properties of the alloy are comparable across all coatings, but their impact on wear resistance varies considerably. To use WC (tungsten carbide) coated aluminum alloy 2024 as a drill pipe material would be the most beneficial for petroleum production. In contrast, WC+Ni-Cr-Si coating is the least recommended one.