

Contents

1	Physico-Chemical Properties and Corrosiveness of Crude Oils and Petroleum Products	1
1.1	Crude Oil Characteristics	2
1.1.1	Chemical Compounds in Crude Oils	2
1.1.2	Corrosive Characteristics of Crude Oils	3
1.2	Physico-Chemical Characteristics of Petroleum Products	8
1.2.1	Corrosiveness of Petroleum Products	11
	References	19
2	Fuel Additives	23
2.1	Action of Fuel Additives and Their Application	24
2.2	Additives to Fuel Oils	37
2.3	Additives for Prevention Oil-ash and Cold-end Corrosion in Boilers	38
2.3.1	Combustion Improvers	39
2.4	Risks and Benefits in the Use of Fuel Additives: The Environmental Balance	40
	Recommended Literature	40
3	Fuel Oxygenates	43
3.1	Alcohols as Fuel Oxygenates	44
3.2	Ethers as Fuel Oxygenates	45
	References	47
4	Biofuels	49
4.1	Additives to Biofuels	54
4.1.1	Additives to Biodiesel	54
	Recommended Literature	55
5	Corrosion of Metallic Constructions and Equipment in Petroleum Products	57
5.1	General Theory of Corrosion	58

5.2	Corrosion Phenomena	60
5.3	Corrosion in Petroleum Products	65
5.3.1	Electrical Conductivity of Petroleum Products and Their Corrosiveness	69
5.4	Microbial Contamination of Fuels	73
5.4.1	Microbial Contamination of Bioidiesel	79
5.4.2	Participation of Microorganisms in Corrosion of Metals in Fuels	81
5.5	Corrosion in Biofuels	90
5.5.1	Physico-Chemical Properties of Biofuels.....	90
5.5.2	Corrosion of Metals in Alcohols.....	92
5.5.3	Corrosion of Metals in Biodiesel.....	101
5.6	Corrosion in the Atmosphere	107
5.7	Corrosion in Soil	109
5.8	Corrosion of Tanks Containing Petroleum Products.....	114
5.9	Corrosion of Tanks and Pipelines Under Thermal Insulation	130
5.9.1	Prevention of Corrosion Under Thermal Insulation.....	134
	References	134
6	Polymeric Materials in Systems for Transportation and Storage of Fuels.....	145
6.1	Polymers and Their Properties	146
6.1.1	Permeability of Polymers	150
6.2	Resistance of Polymers to Fuel Oxygenates and Aromatics	150
6.3	Aggressiveness of Biofuels to Polymers	151
6.3.1	Aggressiveness of Alcohols to Polymers.....	152
6.3.2	Aggressiveness of Biodiesel to Polymers.....	152
	References	156
7	Corrosion Prevention and Control in Systems Containing Fuels.....	159
7.1	Choice of Materials	160
7.2	Coatings.....	164
7.2.1	Antistatic Coatings for Anti-corrosion Protection of Inner Surface of AST Containing Gasoline and Naphtha.....	166
7.2.2	Coating Systems for Protection of Outer Surface of AST Containing Crude Oil and Fuels.....	166
7.2.3	Coating Systems for Protection of Outer Surface of Underground and Submerged Pipelines	167
7.2.4	Metallic Coatings.....	167
7.2.5	Recommendations for the Selection Coating System	169
7.2.6	Testing of Coating Compatibility Under the Condi- tions of Fuel Storage Tanks	169
7.2.7	Experience of Anti-corrosion Protection of AST	171

7.3	Cathodic Protection.....	172
7.3.1	Internal Cathodic Protection.....	173
7.3.2	Cathodic Protection of the External Surface of AST Bottoms, UST, Underground and Submerged Pipelines	173
7.4	Corrosion Inhibitors	174
7.4.1	Liquid Phase	174
7.4.2	Vapor Phase	175
7.5	Anti-Bacterial Treatment.....	178
7.6	Technological Measures.....	178
7.7	Combined Methods of Corrosion Control.....	179
7.8	Secondary Containment and Double Bottom.....	179
7.9	Underground Storage Tanks	180
	References	181
8	Corrosion Monitoring and Nondestructive Testing in Systems Containing Fuels	187
8.1	Control of Physical Properties of a Metal	188
8.1.1	Ultrasonic Technique (UT).....	189
8.1.2	Acoustic Emission (AE)	191
8.1.3	Magnetic and Electromagnetic Methods	192
8.1.4	Eddy Current Technique	193
8.1.5	Other Physical NDT Methods	194
8.1.6	Weight Loss and Electrical Resistance (ER) Methods	196
8.2	Examination and Control of the Environment	197
8.3	Control the Interphase Metal–Environment.....	198
8.4	On-Line, Real-Time CM	198
8.5	Monitoring of Cathodic Protection	201
8.6	Inspection of Tanks	202
8.6.1	Conclusion	203
	References	204
9	Cases of Typical and Unusual Corrosion of Tanks	211
9.1	Corrosion of Outer Surface of Tanks' Shell Under Bricks.....	211
9.1.1	Case 1	211
9.1.2	Case 2	212
9.1.3	Case 3	212
9.1.4	Case 4. Outside and Inside Corrosion of the AST Containing Gas Oil.....	213
9.1.5	Case 5. Corrosion Under Thermal Insulation of the AST Containing Asphalt.....	215
9.1.6	Case 6. General Corrosion and Coating Failure in Gasoline AST.....	216
9.1.7	Case 7. General Corrosion and Coating Failure in the AST (separator).....	216

9.1.8 Case 8. Inner Corrosion of AST Containing Kerosene	217
9.1.9 Case 9. Corrosion of Inner Surface of the Bottom of AST Containing Gas Oil	219
9.1.10 Case 10. Underground Storage Tank (UST) containing LPG.....	219
Recommended Literature	220
10 History of Crude Oil and Petroleum Products.....	221
10.1 History of Anti-knock Additives to Gasoline, Kerosene, Diesel fuel, Fuel oil and Asphalt	223
Recommended Literature	226
Appendix.....	227
Glossary	281
Index.....	291

Corrosion in Systems for Storage and Transportation of
Petroleum Products and Biofuels

Identification, Monitoring and Solutions

Groysman, A.

2014, XIX, 297 p. 75 illus., 25 illus. in color., Hardcover

ISBN: 978-94-007-7883-2