

# Contents

Preface, ix

## CHAPTER 1

<b>Drilling Muds</b> .....	<b>1</b>
Classification of Muds, 1. Mud Compositions, 4. Additives, 11.	
Cuttings Removal by Sweep Materials, 30. Junk Removal, 30.	
Drilling Fluid Disposal, 31. Characterization of Drilling Muds, 31.	

## CHAPTER 2

<b>Fluid Loss Additives</b> .....	<b>34</b>
Mechanism of Action of Fluid Loss Agents, 34. Polysaccharides, 39.	
Synthetic Polymers, 44.	

## CHAPTER 3

<b>Clay Stabilization</b> .....	<b>58</b>
Properties of Clays, 58. Mechanisms Causing Instability, 61.	
Inhibitors of Swelling, 63. Chemicals in Detail, 64.	

## CHAPTER 4

<b>Bit Lubricants</b> .....	<b>65</b>
Refractory Metals, 65. Natural Compounds, 65.	

## CHAPTER 5

<b>Bacteria Control</b> .....	<b>67</b>
Mechanisms of Growth, 67. Treatments with Biocides, 69.	
Bactericides, 71. Various Biocides, 72. Bacterial Corrosion, 76.	
Assessment of Bacterial Corrosion, 79. Mechanisms of Microbial Corrosion, 80.	

CHAPTER 6

**Corrosion Inhibitors ..... 82**

History, 82. Classification of Corrosion Inhibitors, 82. Fields of Application, 82. Application Techniques, 85. Analytic Procedures, 85. Side Effects, 87. Amides and Imidazolines, 88. Nitrogenous Bases with Carboxylic Acids, 91. Nitrogen Quaternaries, 92. Polyoxylated Amines, Amides, and Imidazolines, 92. Nitrogen Heterocyclics, 98. Carbonyl Compounds, 99. Phosphate Esters, 100. Silicate-Based Inhibitors, 100. Miscellaneous Inhibitors, 100.

CHAPTER 7

**Scale Inhibitors ..... 103**

Scale Inhibition, 103. Mathematical Models, 104. Chemicals in Detail, 104. Characterization, 106.

CHAPTER 8

**Gelling Agents ..... 108**

Basic Mechanisms of Gelling Agents, 108.

CHAPTER 9

**Filter-Cake Removal ..... 120**

Organic Acids, 120. Bridging Agents, 121. Enzymatic Breaker, 122. Peroxides, 123. Oligosaccharide, 124. Oscillatory Flow, 124.

CHAPTER 10

**Cement Additives ..... 125**

Basic Composition of Portland Cement, 126. Special Cement Types, 130. Classification of Cement Additives, 135. Additives in Detail, 135.

CHAPTER 11

**Transport ..... 152**

Pretreatment of the Products, 152. Corrosion Control, 156. Paraffin Inhibitors, 159. Pour Point Depressants, 159. Drag Reducers, 160. Hydrate Control, 162. Additives for Slurry Transport, 163. Additives for Odorization, 164. Cleaning, 164.

## CHAPTER 12

**Drag Reducers** ..... **166**

Operating Costs, 166. Mechanism of Drag Reducers, 167. Drag Reducers in Detail, 171.

## CHAPTER 13

**Gas Hydrate Control** ..... **174**

The Relevance of Gas Hydrates, 174. Inclusion Compounds, Clathrates, 174. Conditions for Formation, 177. Formation and Properties of Gas Hydrates, 178. Inhibition of Gas Hydrate Formation, 180. Hydrate Inhibitors for Drilling Fluids, 182.

## CHAPTER 14

**Antifreeze Agents** ..... **183**

Theory of Action-Colligative Laws, 183. Overview of Antifreeze Chemicals, 184. Heat-Transfer Liquids, 185. Hydraulic Cement Additives, 191. Pipeline Transportation of Aqueous Emulsions of Oil, 191. Low-Temperature Drilling Fluids, 191.

## CHAPTER 15

**Odorization** ..... **192**

Additives for Odorization, 192. Measurement and Odor Monitoring, 192. Uses and Properties, 194.

## CHAPTER 16

**Enhanced Oil Recovery** ..... **196**

Waterflooding, 197. Caustic Waterflooding, 197. Acid Flooding, 199. Emulsion Flooding, 200. Chemical Injection, 203. Polymer Waterflooding, 205. Combination Flooding, 206. Foam Flooding, 208. Carbon Dioxide Flooding, 213. Steamflooding, 214. In situ Combustion, 215. Special Techniques, 215. Microbial-Enhanced Oil-Recovery Techniques, 217. Reservoir Properties, 228. Soil Remediation, 232.

## CHAPTER 17

**Hydraulic Fracturing Fluids** ..... **233**

Stresses and Fractures, 233. Comparison of Stimulation Techniques, 234. Basic Constituents, 235. Types of Hydraulic

Fracturing Fluids, 236. Characterization of Fracturing Fluids, 238. Water-Based Systems, 240. Oil-Based Systems, 265. Foam-Based Fracturing Fluids, 267. Fracturing in Coal-Beds, 268. Propping Agents, 268. Acid Fracturing, 271. Special Problems, 272.

CHAPTER 18

**Water Shutoff ..... 276**

Basic Principles, 276. Chemicals for Water Shutoff, 276.

CHAPTER 19

**Oil Spill–Treating Agents ..... 292**

History, 292.

CHAPTER 20

**Dispersants ..... 309**

Cement, 309. Aqueous Drilling Muds, 311. Miscellaneous, 315.

CHAPTER 21

**Defoamers ..... 316**

Uses in Petroleum Technology, 316. Classification of Defoamers, 317. Theory of Defoaming, 319.

CHAPTER 22

**Demulsifiers ..... 325**

Emulsions in Produced Crude Oil, 325. Waterflooding, 326. Oil Spill Treatment, 326. Desired Properties, 326. Mechanisms of Demulsification, 326. Performance Testing, 327. Classification of Demulsifiers, 328. Chemicals in Detail, 330.

**References ..... 345**

**Index ..... 482**