

# Contents

## CHAPTER 1. THE THEORY OF EMULSIONS AND FOAMS

Emulsions	<i>Page</i>
Introduction .....	1
Surface Tension .....	2
Viscosity .....	15
Solubility .....	23
Hydration .....	30
Volume Relation .....	34
Electric Charge .....	40
Size of Particles of the Disperse Phase and the Distribution of Sizes in an Emulsion System as Factors Relating to the Stability of Emulsions.....	53
Inversion of Phases in an Emulsion System and Factors Influencing It.....	60
Adsorption of the Emulsifying Agent at the Interface, Film Formation, and Variations in the Nature and Thickness of a Film as a Factor in the Stability of an Emulsion .....	71
Orientation of Molecules in the Adsorbed Interfacial Layer as an Explanation of Emulsion Stability and Other Emulsion Properties .....	90
Summary .....	101
1. Factors Influencing Emulsification .....	103
2. Factors Influencing Stability of Emulsion Systems .....	105
3. Factors Producing Inversion of Phases in Emulsion Systems .....	107
Bibliography .....	108
<b>Foams</b>	
Introduction .....	112
Foam Formation .....	112
Origin and Mechanism .....	112
Formation of a single lamina .....	112
Forces acting in a lamina .....	114
Construction of a foam system .....	115
Conclusions .....	116
Factors Influencing Foam Formation .....	116
Vapor pressure and surface tension .....	116
Solubility and surface activity .....	119
Solubility, spreading, and viscosity .....	120
Boundary heterogeneity .....	122
Conclusions .....	127
Stability of Foam Systems .....	128
Factors in the Stabilization of Foam Systems .....	129
Influence of electrolytes .....	130
Action of protective colloids .....	131
Viscosity as a factor in the stabilization of foam systems .....	132
Action of finely divided solids .....	133
Forces Involved in Maintaining Stability .....	135
Electrostatic and capillary forces .....	135
Adsorption layer in the interface of a foam system and its thickness as a factor influencing stability; the Langmuir-Harkins orientation theory .....	136
Conclusions .....	140

	Page
Transition to the Unstable State .....	140
Forces Acting in the Thinning of a Film .....	140
Forces Influencing Transition to the Unstable State .....	142
Conclusions .....	146
Foam Prevention .....	147
Factors Influencing Foam Prevention .....	147
Summary .....	148
Bibliography .....	151

## CHAPTER 2. PRACTICAL KNOWLEDGE OF EMULSIONS

### Emulsification

Introduction .....	153
Methods of Preparing Emulsions .....	161
Emulsifiers .....	167
Electrolytes .....	171
Colloids .....	173
Resin Soaps .....	176
Water-soluble Gums .....	178
Organic Compounds .....	178
Sulfonic Acids and Sulfonated Oils .....	187
Sulfonated Products .....	188
Oils and Prepared Emulsions .....	196
Emulsification Processes .....	197
Types of Equipment Suitable for Use in Emulsification .....	199
Colloid Mills .....	199
Mixing Equipment .....	201
High-pressure Apparatus .....	203
Application of Centrifugal Force .....	204
Stirring Equipment .....	206
Appendix .....	211
Bibliography .....	212

## CHAPTER 3. PRACTICAL KNOWLEDGE OF EMULSIONS

### Demulsification

Introduction .....	219
Demulsification Methods .....	222
Heat Treatment .....	222
Methods and Equipment .....	234
Distillation .....	246
Indirect heat .....	249
Heat combined with mechanical treatment .....	253
Heat and pressure .....	264
Heat combined with centrifuging and filtration .....	268
Action of Chemicals and Demulsifying Agents .....	270
Demulsifiers .....	285
Acids, bases and salts .....	291
Solids .....	293
Gases .....	295
Colloids .....	297
Soaps .....	297
Alcohols .....	299
Hydroxy-derivatives .....	300
Condensation products .....	301
Organic acids and their salts .....	301

	Page
Sulfonated compounds .....	308
Blown oils .....	320
Distillation products (acid and alkali sludge, cracked residue, paraffin wax) .....	322
Freezing and Diluting .....	327
Desalting .....	328
Filtration .....	334
Electric Dehydration .....	338
Methods and equipment .....	344
Magnetic Dehydration .....	372
Centrifuging .....	373
Refining Processes and Methods for Preventing and Resolving Emulsions..	379
Bibliography .....	386

## CHAPTER 4. PRACTICAL KNOWLEDGE OF EMULSIONS

### Asphalt and Bitumen Emulsions

<b>Introduction</b> .....	396
Emulsification of Asphalt and Bitumen .....	405
Specific Methods for Stabilization of Asphalt Emulsions .....	421
Preparation of Bitumen Emulsions for Road Construction .....	426
Stability of Bitumen Emulsions used in Road Construction .....	429
Analyses of and Tests for Asphalt-Bitumen Emulsions .....	433
Methods employed in the Analysis of Asphalt Emulsions .....	434
Various Tests for Asphalt-bitumen Emulsions .....	435
Bibliography .....	441

### Lubricants and Lubricating-Oil Emulsions

<b>Introduction</b> .....	445
<b>Lubricating Power as a Function of Various Properties of a Lubricating Oil</b>	447
Emulsibility and Viscosity .....	448
Capillarity .....	449
Adsorption and Wetting Ability .....	451
Oiliness .....	453
Various Tests for Lubricating Oils .....	454
Oiliness .....	454
Polarity and adhesion of the lubricant .....	455
Compressibility and tensile strength .....	456
Resistance to emulsification and sludge formation .....	457
Stability .....	458
Emulsification and demulsification .....	459
<b>Methods for the Preparation of Lubricants and Lubricating-Oil Emulsions</b>	461
Bibliography .....	465

## CHAPTER 5. LABORATORY METHODS USED IN THE EXAMINATION OF EMULSIONS'

<b>Introduction</b> .....	458
Sampling of Emulsions .....	468
Sampling Apparatus used in Well Gauging .....	470
Microscopic Examination .....	473
Test Methods .....	492
Surface Tension Measurements .....	494
Interfacial Tension Measurements .....	500
Spreading Tension Measurements .....	504

	<i>Page</i>
Wetting Tension Measurements .....	504
Viscosity Tests .....	507
Measurements of Electrical Properties .....	509
Emulsification and Demulsification .....	522
Investigation of the Emulsifier .....	525
Investigation of the Demulsifier .....	529
Stability .....	530
Determination of Emulsion Type .....	531
Determination of Emulsion Constituents .....	532
Salt and Acid .....	532
Oil .....	535
Water .....	537
Appendix .....	549
Origin of Petroleum .....	549
Physical Properties of Petroleum Indicating its Source .....	550
Oil Tests .....	553
Bibliography .....	561
Author Index .....	565
Subject Index .....	575