

CONTENTS

<i>List of Contributors</i>	xi
<i>Introduction</i>	xiii
<i>Chapter 1</i>	
THE SOLID-LIQUID INTERFACE — M. J. JAYCOCK	
Forces Between Atoms, Ions and Molecules	2
Attractive and repulsive forces between molecules	2
Coulombic forces between ions	2
Interaction between a permanent dipole and an ion	2
Interaction between two permanent dipoles	2
Polarisability	4
Description of an Interface	4
Surface tension	5
Total surface energy	5
Surface entropy	6
Interfacial tension	6
The Solid Surface	7
Surface mobility	7
Conditioning of solid surfaces	8
Surface tension and surface free energy	9
Calculated values of surface tension and surface energies	10
Energies associated with edges and corners	13
Specific surface area	14
The surface of real solids	19
Wetting and Contact Angles	22
Magnitude of contact angles	23
Spreading coefficients	24
The adhesion of liquids to solids	25
Flotation	25
Wetting and non-wetting	27
Adhesion	27
Adhesive forces	27
The stickiness of particles	29

CONTENTS

Sliding friction and lubrication	
Rolling friction	
Adsorption from Solution	
The composite isotherm	
Adsorption from completely miscible liquids	
Adsorption from partially miscible liquids	
Adsorption of dissolved solids from solution	
The adsorption of polymers	
The adsorption of electrolytes	

Chapter 2

ELECTRICAL PHENOMENA ASSOCIATED WITH THE SOLID-LIQUID INTERFACE — *A. L. SMITH*

Introduction	
The Electric Double Layer	
Origin of the electric double layer	
The nature and definition of electric potentials in the double layer	
Potential determining ions and the Nernst equation	
Adsorption of non-potential determining ions and the inner part of the double layer	
Adsorption of dipolar molecules	
The Stern adsorption isotherm and the discreteness of charge effect	
The diffuse region of the double layer in solution	
Capacity of the diffuse region of the double layer	
Double layer on the solid side of the interface	
Free energy of the diffuse double layer	
Electrokinetic Properties of Dispersions	
Classification	
The zeta potential	
Experimental determination of electrophoretic mobilities	
Stationary levels in microelectrophoresis cells	
Choice of microelectrophoresis cell	
Experimental detail	
Optical corrections	
Accuracy of electrophoretic mobilities	
Conversion of mobilities to zeta potentials	

Chapter 3

FUNDAMENTAL ASPECTS OF DISPERSION *G. D. PARFITT*

The Dispersion Process	
The three stages of the dispersion process	
Dispersibility	
Wetting of the external and internal surfaces	
Mechanical breakdown of clusters	
Stability	
Maximum rate of flocculation	
Forces of interaction between particles	

London-van der Waals attractive forces	92
The coulombic repulsive force	96
The total interaction energy	98
Rate of slow flocculation	101
Application of the DLVO theory	102
Stability arising from adsorbed layers	109
Concentrated dispersions	118

Chapter 4

PRECIPITATION — A. G. WALTON

Introduction	122
The Metastable Limit	123
Formation and Stoichiometry of Clusters and Metastable Phases	124
Nucleation Theory	128
Homogeneous nucleation	128
Heterogeneous nucleation	130
Criticisms of nucleation theory	131
Nucleation of Polymers	131
Secondary or Ancillary Nucleation	132
The Role of the Impurity Substrate—Epitaxy	132
Experimental Tests of Nucleation Theory	135
Heterogeneous nucleation	135
Homogeneous nucleation	137
Solution Phase Nucleators	141
Effect of Nucleation Mechanism on Precipitate Characteristics	142
Precipitation Kinetics	144
Precipitate Morphology	150
Ageing and recrystallisation	158
Summary	161

Chapter 5 *a. f.*

ASSESSMENT OF DISPERSION — S. H. BELL and V. T. CROWL

Introduction	165
The Nature of Powders	167
The Process of Dispersion	170
Technological Properties of Dispersion	171
Sedimentation behaviour	172
Rheological behaviour	174
✓ Methods of Assessment of the Degree of Dispersion and Dispersion Stability	178
Control tests for degree of dispersion	178
✓ Particle size analysis	180
Sedimentation behaviour	186
Rheological properties	190
Optical properties	192
Miscellaneous methods	196
✓ The Nature of Practical Dispersions	

*Chapter 6***SURFACE-ACTIVE COMPOUNDS — *W. BLACK***

Introduction	.	.	.	.	.
Surface Activity	.	.	.	.	.
Properties of Surface-active Agents	.	.	.	.	.
Selection of Surface-active Agents	.	.	.	.	.
Dispersion of Pigments in Aqueous Media	.	.	.	.	.
Foaming	.	.	.	.	.
Water-based stoving paints	.	.	.	.	.
Miscellaneous aqueous dispersions	.	.	.	.	.
Dispersion of Pigments in Non-aqueous Media	.	.	.	.	.
Universal Tinters	.	.	.	.	.
Pigment Flushing	.	.	.	.	.
Pigment-resin Printing of Textiles	.	.	.	.	.
Problems and Prospects	.	.	.	.	.

*Chapter 7***TECHNICAL ASPECTS OF DISPERSION — *I. R. SHEPPARD***

Introduction	.	.	.	.	.
Definitions and Objectives	.	.	.	.	.
Classification of Type of System Involved	.	.	.	.	.
Range of Equipment Available	.	.	.	.	.
Low shear rate equipment	.	.	.	.	.
High shear rate mixers	.	.	.	.	.
Ball mills	.	.	.	.	.
Roll mills	.	.	.	.	.
Range of Industries and Types of Product	.	.	.	.	.
Adhesives	.	.	.	.	.
Ceramics and refractories	.	.	.	.	.
Chemicals	.	.	.	.	.
Paint	.	.	.	.	.
Paper industry	.	.	.	.	.
Pharmaceuticals	.	.	.	.	.
Pigments and dyestuffs	.	.	.	.	.
Plastics	.	.	.	.	.
Printing inks	.	.	.	.	.
Rubber	.	.	.	.	.
Economics of Dispersion Operations	.	.	.	.	.
Dispersion Stage Optimisation and Formulation	.	.	.	.	.
Optimisation experiments	.	.	.	.	.
Use of rheology	.	.	.	.	.
Extraction from final formulation	.	.	.	.	.

*Chapter 8***INORGANIC PIGMENTS — *H. D. JEFFERIES***

Introduction	.	.	.	.	.
Classification	.	.	.	.	.
Manufacture	.	.	.	.	.
Pigments in paints and inks	.	.	.	.	.

CONTENTS

The colour of inorganic pigments	289
Physical and Chemical Aspects of Inorganic Pigments	290
✓ Particle size distribution	290
Rugosity, roughness or smoothness factors	291
The effect of milling (micronising) of pigments	292
The chemical composition of the surface	295
Dispersion of Inorganic Pigments	296
Interaction of pigment with medium—oil absorption	297
✓ Pigment wetting in practice	299
The breakdown of aggregates and agglomerates	303
✓ Practical mill base formulation—the Daniel flow point	306
Rheological aspects of dispersion	309
The achievement of a disperse state	315
Influence of the Degree of Pigment Dispersion on the Optical Properties of Surface Coatings	319

Chapter 9

ORGANIC PIGMENTS — *H. D. BREARLEY and F. M. SMITH*

Introduction	325
Chemical Classification of Organic Pigments	326
Physical Properties Relating to Application Properties	329
✓ Particle size as a powder	329
✓ Particle size in dispersion	330
Surface area and crystal shape	334
Interfacial energies	335
The Application of Pigments	336
Extremely high viscosity systems	337
Very high viscosity systems	337
High viscosity systems	337
Medium viscosity systems	339
Low viscosity systems	340
The Dispersion of Organic Pigments	341
Conclusions	344