DICTIONARY OF COLLOID AND INTERFACE SCIENCE

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An Institute of Alberta Research Council

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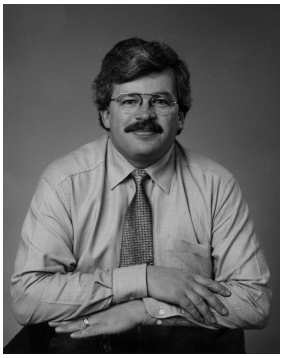

Laurier L. Schramm is Executive Director of the Petroleum Recovery Institute, an Institute of Alberta Research Council, where he has held this and numerous other positions since 1988. He is also an Adjunct Professor of chemistry at the University of Calgary, where he leads a research group and lectures in applied colloid and interface chemistry. He received his B.Sc. (Hons.) in chemistry from Carleton University in 1976 and his Ph.D. in physical and colloid chemistry in 1980 from Dalhousie University, where he studied as both a Killam and an NSERC Scholar. From 1980 to 1988 he held research positions with Syncrude Canada Ltd. in its Edmonton Research Centre.

His research interests have included many aspects of colloid and interface science applied to the petroleum industry, including research into mechanisms of new processes for the enhanced recovery of light-to-heavy crude oils, such as foam, polymer, and surfactant flooding, and research into fundamental and applied aspects of the hot water flotation process for recovering bitumen from oil sands. These subjects have involved investigations into emulsions, suspensions, hydrocarbons, and foams in terms of rheology, electrokinetics, dynamic surface and interfacial tensions, phase attachments, and the reactions and interactions of surfactants. Dr. Schramm's work on the development of oil-tolerant foams for enhanced oil recovery was recently judged to be a Milestone of Canadian Chemistry in the 20th Century by the Canadian Society for Chemistry. He has won several other national awards for his research and is a Fellow of the Chemical Institute of Canada. He has more than 100 scientific publications and patents. This is his seventh book.

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This book was made possible through the support of my family, Ann Marie, Katherine, Victoria, and my parents, William and Joan, all of whom have provided consistent encouragement and support.

I thank my colleagues who invested considerable time and effort reviewing various drafts of this book and contributing comments and suggestions. There are too many such colleagues to list here, but Karin Mannhardt, Loren Hepler, Randy Mikula, Elaine Stasiuk, and Susan Kutay were especially helpful. I also thank the staff of John Wiley & Sons Inc., especially Darla Henderson, Amy Romano, Camille Carter, and Christine Punzo.

Because there are so many different, specialized references to aspects of colloidal systems in industrial practice, some important terms will inevitably have been missed. I will greatly appreciate it if readers would take the trouble to inform me of any significant errors or omissions.

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INTRODUCTION

In the early 1800s Thomas Graham studied the diffusion, osmotic pressure, and dialysis properties of a number of substances, including a variety of solutes dissolved in water (see references [1, 2, 3]). He noticed that some substances diffused quite quickly through parchment paper and animal membranes and formed crystals when dried. Other substances diffused only very slowly, if at all, through the parchment or membranes and apparently did not form crystals when dried. Graham proposed that the former group of substances, which included simple salts, be termed "crystalloids," and that the latter group, which included albumen and gums, be termed "colloids." Although colloidal dispersions had certainly been studied long before this time, and the alchemists frequently worked with body fluids, which are colloidal dispersions, Graham is generally regarded as having founded the discipline of colloid science.

The test of crystal formation later turned out to be too restrictive, the distinction of crystalloids versus colloids was dropped, and the noun colloid was eventually replaced by the adjective colloidal, indicating a particular state of matter: matter for which at least one dimension falls within a specific range of distance values. The second property that distinguishes all colloidal dispersions is the extremely large area of the interface between the two phases compared with the mass of the dispersed phase. It follows that any chemical and physical phenomena that depend on the existence of an interface become very prominent in colloidal dispersions. Interface science thus underlies colloid science[1].

Now, 200 years later, a vast lexicon is associated with the study of colloid and interface science because, in addition to the growth of the fundamental science itself, we recognize a great diversity of occurrences and properties of colloids and interfaces in industry and indeed in everyday life. Many other scientific disciplines become involved in the study and treatment of colloidal systems, each discipline bringing elements of its own special language. This

[1]Here again we encounter evidence of a living language. Following Graham's identification of a new division of chemistry, colloid chemistry, the realization of the profound importance of the interface between the phases led subsequent chemists to refer to the discipline as colloid and capillary chemistry (meaning colloid and interface chemistry). In view of the wide interdisciplinary nature, I prefer the term colloid and interface science.

book provides brief explanations for the most important terms that may be encountered in a study of the fundamental principles, experimental investigations, and industrial applications of colloid and interface science. Even this coverage represents only a personal selection of the terms that could have been included were there no constraints on the size of the book.

I have tried to include as many important terms as possible. The difficulty of keeping abreast of the colloid science vocabulary has been worsened by the tendency for the language itself to change as the science has developed, just as the meaning of the word colloid has changed. Many older terms that are either no longer in common use, or worse, that now have completely new meanings, are included as an aid to the reader of the older colloid and interface science literature and as a guide to the several meanings that many terms can have. In addition, cross-references for the more important synonyms and abbreviations are included. Some basic knowledge of underlying fields such as physical chemistry, geology, and chemical engineering is assumed. Many of the important named colloids and phenomena (such as Pickering emulsions), equations, and constants are included, although again this selection represents only some of the terms that could have been included. Finally, I have also included a selection of brief biographical introductions to more than 60 scientists whose names are associated with famous named phenomena, equations, and laws in colloid and interface science. Students first become aware of the people that have laid the foundation for a scientific discipline as they encounter these eponyms. By adopting the "students' view" of famous names in the field, it will be seen that in some cases the scientists are very famous, and biographies are readily found. In other cases, the scientists are not as well known, and in some cases their contribution to colloid and interface science was otherwise slight. For those interested in this feature specifically, I have included an index of famous names in colloid and interface science for easy searching.

Specific literature citations are given when the sources for further information are particularly useful, unique, or difficult to find. For terms drawn from fundamental colloid and interface science, much reliance was placed on the recommendations of the IUPAC Commission on Colloid and Surface Chemistry (reference [4]). Numerous other sources have been particularly helpful in colloid and interface science (textbook references [5, 6, 7, 8, 9, 10]) and its subdisciplines and other specialized fields (references [11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26]). I recommend these sources as starting points for further information. For the famous names entries, I have drawn on a number of general references [27, 28, 29, 30, 31, 32] and have also included numerous specific references for those interested in additional information.

DICTIONARY OF TERMS