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Developments in Mineral Processing

D.W. Fuerstenau/advisory editor

Colloid Chemistry in Mineral Processing

J. S. Laskowski and J. Ralston (Editors)

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Colloid Chemistry in Mineral Processing

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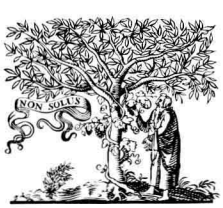

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Colloid Chemistry in Mineral Processing

Foreword

"Colloid Chemistry in Mineral Processing" was born out of our strong desire to recognise the excellent scientific studies of Dr. Joseph A. Kitchener in a tangible and constructive manner.

Joe Kitchener influenced, guided and educated many scientists and engineers during his impeccable career. We therefore approached distinguished researchers, all of whom had either worked directly with Joe or came from research groups with which he had a long association, and asked them to contribute specific chapters to the book.

Since the size of the particles which are currently processed is rapidly approaching colloidal range, mineral processing is, of necessity, becoming more and more an applied colloid chemistry. Colloid chemistry is inevitably involved in all aspects of

Joseph and Phyllis Kitchener at home in Tewin Wood, Hertfordshire, England (September 1989).

mineral processing, ranging from rheological phenomena in grinding, selective adsorption of various chemical additives (flotation collectors, flocculants, dispersants, etc.) onto mineral surfaces, and analysing the forces which control the stability of dispersions as well as the wettability of mineral surfaces. Colloid chemistry also plays an equally important role in influencing the stability and viscosity of magnetite dense media. Surface phenomena control both the dewatering of "fines" and are involved in dust suppression. Joe Kitchener worked in these and related areas, and it is pertinent to recall aspects of his career, for this will serve the dual purpose of informing readers who have not had the privilege of working with him as well as developing some historical perspective of the subject of the book.

Joe Kitchener was born in London in 1916 and attended an excellent council grammar school from 1926 to 1934. At the conclusion of his secondary education, Joe won an open scholarship to University College, were he skipped the first year of the Bachelor's degree and obtained first class honours in Chemistry in 1936. His Ph.D. was completed by June 1938, just three years and nine months after leaving secondary school, a truly remarkable feat from the editors' viewpoint, although would demur on this issue! His Ph.D. topic was "Photosensitization" by Titanium Dioxide", undertaken under the energetic direction of C.F. Goodeve, a notable physical chemist in the Department of Chemistry headed by Professor F.G. Donnan. The research environment was very stimulating for G.S. Hartley, N.K. Adams and H. Freundlich had all been recruited by Donnan, thus there was a rich colloid and surface chemistry milieu for a young doctoral student to develop in.

At the conclusion of his doctoral studies Joe was appointed as a Demonstrator in Physical Chemistry at Imperial College, enabling him to combine teaching and independent scientific research. By 1956 he was Reader in Physical Chemistry and was awarded the D.Sc. in 1958 for his eminent contributions, exceeding fifty in number, to the scientific literature. In 1961 the Department of Mining and Mineral Technology, led by the perceptive Professor M.G. Fleming, lured Joe away from Chemistry and conferred upon him the unique titie of "Reader in the Science of Mineral Processing". Joe completed forty years on the staff of Imperial College in 1978 at which point the College, coaxed by Fleming, bestowed the coveted title of Senior Research Fellow upon him. Joe enjoyed this role for the next seven years, finally leaving Imperial College in 1985. He now lives in Tewin Wood, near Welwyn in Hertfordshire with his gracious wife Phyllis. Joe and Phyllis have two daughters and a son. Since his departure from Imperial College, Joe and Phyllis travel widely in the United Kingdom and involve themselves in a myriad of activities, with Joe still indulging in the occasional scientific foray.

More than one hundred and fifty scientific publications flowed from Joe's scientific work. Many of these are noted in this book, both in the body of the text, as well as in the bibliographies at the end of each chapter. However it is worth mentioning a few highlights here. With A.P. Prosser, Joe made the first correct measurements in the West of long-range van der Waals forces between macroscopic bodies (Proceed-

ings of the Royal Society of London (1957) A 242, p. 403). This work was carried out in parallel with Derjaguin and his group in Russia and, as a result, a strong bond was forged between the two men. Their mutual fascination with each other's work continues until this day, with Joe Kitchener assuming editorship of Derjaguin, Churaev and Muller's book on "Surface Forces" (Consultants Bureau, New York and London, 1987).

There was a long-term interest in thin liquid films, encompassing surface forces, film thickness measurements and structural effects. Collaborators in this work included A.D. Read, J.S. Laskowski, T.D. Blake and R.M. Pashley. Surfactant adsorption at solid–water interfaces was performed in conjunction with R. Tolun and T.Z. Saleeb. "Mechanisms of Adsorption from Aqueous Solutions: Some Basic Problems", a review by Joe which was published in the Journal of Photographic Science in 1965 (13, p. 152), to this day remains an excellent introduction for a newcomer to this field. Pioneering selective flocculation studies were carried out with J.P. Friend, B. Yarar, J. Rubio and Y.A. Attia whilst the phenomenon of selective coagulation in mixed colloidal suspensions was confirmed with R.J. Pugh. Sulphide mineral surface chemistry and flotation were investigated with R. Tolun, M.G. Fleming and B. Yarar whilst the surface properties of silicates were studied with J. Ralston and L.J. Warren. Quebracho and the mechanism of its action as a depressant was investigated with J. Iskra and C. Gutierrez. Adsorption investigations were carried out with O. Mellgren and H. Shergold whilst joint studies into dissolved air flotation were performed with R. Gochin and J. Solari. Fine particle and fundamental flotation studies were performed with J.F. Anfruns, S. Sobieraj, H. Wright and M. Urban. Although Phil Parsonage and Luuk Koopal were never directly associated with Joe Kitchener, they rapidly accepted our invitation to write their respective chapters, without which the book would be incomplete. Joe's scientific work is characterized by brilliant diagnostic experiments, lucid, perceptive interpretations and a remarkable clear exposition. We cannot do justice to his work by a few mere lines here — the reader is urged to consult the original literature for the full flavour.

The book is divided into two sections, the first of which commences with an analytical overview by Joe Kitchener. Each chapter is couched in the form of a review, but is written with the prospective student in mind. We therefore hope that it will be a useful teaching book. The editors have attempted to give coherence to the entire volume. We thank our contributors and Elsevier, particularly Jacques Kiebert, for their support and our families for their tolerance. The blame for any errors or omissions rests with us. We trust, however, that our readers will find this book to be a valuable contribution to the "science of mineral processing".

May, 1991

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