

BOOK REVIEWS

Magnetic Fluids, E. Blums, A. Cebers and M.M. Maiorov, De Gruyter, Berlin, New York: 1997, US\$280.00, 416 pp. ISBN 3-11-014390-9.

The book *Magnetic Fluids* which appeared in 1997 is the first general review of magnetic fluid research since the famous monograph *Ferrohydrodynamics* by R.E. Rosensweig published in 1985. In contrast to all other books appearing in the past twelve years, which were mainly focused on applications of ferrofluids, *Magnetic Fluids* provided the reader not only with one certain aspect of the research on magnetic fluids but with an overview covering nearly all fields of this interdisciplinary research area. Only the applications of magnetic fluids were not included and the discussion concerning the preparation of the magnetic fluids in the final chapter is quite short, indicating that it is not within the main focus of the book. However, it is not a disadvantage since it enabled the authors to pay more attention to the basic principles of ferrofluids.

To underline the basic approach, the authors start with a discussion of the magnetic properties of small particles in general. This is used as a base for description of the most important part of the properties of ferrofluids, namely their magnetic behaviour. The authors use their deep knowledge in respect to this matter to extend the discussion to the magnetization kinetics and the effects of particle interaction. Afterwards, they introduce the well-known stability requirements for ferrofluids, adding a large volume of information on the experimental possibilities to clear up the structural properties of the liquids.

In the following chapters the basics of ferrohydrodynamics are discussed in a very intense theoretical approach. All effects which are discussed to illustrate the special features of the magnetic fluids, are underlined by experimental results. For instance, parametric excitation of a free ferrofluid surface is derived in detail and illustrated by

photographs showing the experimental realization of the phenomenon. Much attention is paid to internal rotation in ferrofluids, and thus to the magnetoviscous effect. However, the authors do not only discuss the effect of the rotational viscosity but also quite a new and upcoming field of rheology of ferrofluids.

In the last chapter dealing with the effects of the magnetic fields on the behaviour of the magnetic fluids, the influence of the magnetic forces on heat and mass transfer in ferrofluids is outlined. Phenomena like thermomagnetic convection of magnetodiffusion are discussed in detail from a theoretical point of view. Again, they are accompanied by experimental results showing the possibilities as well as the problems of the magnetic fluid research. In this chapter, as well as in the whole book, the long-term experience of the authors in the ferrofluid research and their activities in almost all of the discussed problems provide the reader with a deep insight into the development of this research field.

All chapters provide problems with solutions, to give the reader a possibility to check his/her own understanding of the discussed subjects. As a point of criticism, one should note that the reference list has not nearly been updated after being translated from the Russian original in 1989. Thus many new publications and results in the discussed research areas have not been included. Nevertheless, the reference list provides the reader with an excellent basis for further study of magnetic fluids.

Finally, it can be stated that *Magnetic Fluids* will not, owing to its deep theoretical approach, directly replace the basic book by Rosensweig. But for experienced readers, as well as for researchers interested in a deeper insight into the field of the ferrofluid research, it will become indispensable.

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Column Flotation 96, Proceedings of the International Symposium on Column Flotation, Montreal, Quebec, Canada, August 26–28, 1996. C.O. Gomez and J.A. Finch (Eds.). The Metallurgical Society of the Canadian Institute of Mining, Metallurgy and Petroleum, Montreal, Quebec, Canada 1996, 398 pp. CND\$145.00.

Column '96 are the Proceedings of the Third International Symposium on Column Flotation, held in Montreal from August 26–28, 1996. The editors are Cesar Gomez, who also acted as co-chairman and Jim Finch from McGill University. The first two conferences on column flotation were held in Phoenix, Arizona (1988) and in Sudbury, Ontario (1991). The purpose of these conferences is to illustrate the current status as well as future trends of column flotation technology.

Column '96 managed to achieve a good balance between research focused and industry-related papers. Also, a special effort was made to include papers from different countries, an approach which is always useful to obtain different perspectives on the same topic. The 31 papers presented in the Proceedings are divided into eight sessions, dealing with different aspects of column flotation operation. Of particular significance in the session on Bubble generation is the work by Brake *et al.* on the development of the Microcel sparging system. In the Testing session, the determination of rate constants and selectivity measurements (Xu and Stratton-Crawley) and the development of a batch procedure for flotation column testwork (Flint) deserve special mention.

The importance of column flotation Fundamentals was addressed both from a Modelling and a Hydrodynamics perspective. The work by Gorain *et al.* is significant in that it showed that flotation rate is closely related to the bubble surface area flux in a cell, and not to individual gas dispersion properties. The session on Plant practice, which covered sulphide and non-sulphide minerals as well as non-mineral applications, accounted for nearly half of the papers. I particularly enjoyed the two contributions on integrating columns into existing plants (Furey) and industrial applications of column cells as roughers (Wyslouzil). Both papers are comprehensive and give a good perspective on the logistics and operational issues relating to column plant management. The growing application of columns to non-minerals was illustrated well by papers on ion flotation, the deinking of recycled paper and the removal of organic material from aqueous streams. Contributions of

significance in the Instrumentation and Control session are the application of expert supervisory control systems (McKay and Ynchausti), and the development of an on-line sensor system for determining air, water and solids percentages in flotation pulps and froths (Labuche *et al.*).

From a process and equipment innovation point of view, the conference disappointed somewhat in that little of the reported work and concepts are novel. If the purpose of the conference is to also highlight future trends in column flotation technology, more emphasis should be placed on this aspect. It was also somewhat unsettling to see in one paper that a well-established principle such as the venturi aerator was presented as a new development!

The Jameson cell was first introduced to the minerals industry at the Column '88 conference. Much work is still being carried out on modelling and plant application, and three papers at Column '96 dealt with this technology specifically. Of specific interest here is the paper by Evans *et al.* on hydrodynamic studies characterising bubble break-up inside the downcomer and gas dispersion patterns inside the cell. It has been 10 years since the invention of the Jameson cell, and one cannot help wondering when the next breakthrough innovation in column flotation will occur.

Column '96 is a good reference, and I believe essential for plant personnel and researchers alike. Its value lies in the good balance between industrial case studies and research oriented investigations. However, although the grammar is generally of a good standard, some glaring mistakes give the impression that the editing was done rather haphazardly or in a technical sense only. Some papers, especially some from non-English speaking countries, are difficult to read and interpret.

Overall, Column '96 continues the tradition set by the first two conferences. Perhaps the fact that the Column conferences are not held on an annual basis contributes to the favourable impression – the next Column conference is something to look forward to rather than a routine annual event. It also allows a greater period in which significant work can come to full fruition. The expertise of the McGill team and the organising committee is evident.

The proceedings are presented in a durable hardcover, well bound, and will be a good addition to any technical bookshelf. Perhaps one

suggestion. It would be useful if the e-mail addresses of authors were included as well, to simplify and foster correspondence.

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