Wetting and Spreading Dynamics

By Victor M. Starov, Manuel G. Velarde, and Clayton J. Radke, CRC Press, Taylor & Francis, Boca Raton, FL, 2007, 515 pp.

The authors provide in five chapters a comprehensive treatment of how liquids spread on solids.

The first three chapters of the book discuss equilibrium and kinetics in a very systematic and theory-based way. A plethora of topics is addressed, such as:

- Macroscopic liquid drops, microdrops, flat films, periodic films, depressions, interacting droplets, cylindrical droplets, menisci;
- Flat surfaces, capillaries, rough substrates, locally heterogeneous surfaces, curved surfaces, soft solids, fibers, pre-wetted substrates;
- Stability and metastability, line tension, capillary interaction between partially immersed solid bodies, capillary and gravitational spreading, static and dynamic contact angles, complete and partial wetting, static hysteresis, boundary viscosity, influence of imposed temperature gradients.

Numerical approaches are rather the exception than the rule in Chapters 1 to 3, with analytical solutions derived and explained wherever possible. The first three chapters of the book have a clear mission: The mission of explaining how surface forces—expressed by means of disjoining pressure isotherms—can affect wetting and spreading phenomena, and how they give rise to regions of gradual transition between wet and dry parts of the substrate, and also, how they can bridge the gap between the study of wetting on the one side, and colloid science on the other side. The authors do not conceal the importance that this mission has for their book, invest great effort in derivations under consideration of both capillary and surface forces, and do not hesitate to stress and repeat interpretations and conclusions of fundamental importance, and are—at the end—successful in their mission: Readers who, after the lecture in the book by Starov et al., are still unaware of the importance of surface forces, and of the peculiarity of disjoining pressure isotherms for water and aqueous solutions, probably will never learn better, and, thus, be persuaded. Despite such emphasis, the authors never lose contact to more conventional approaches, but present them in the sense of asymptotic solutions, and discuss them with thoroughness and fairness.

The remaining two chapters (Chapters 4 and 5) deal with spreading over porous surfaces, or in the presence of surfactants. The authors still keep their line of deriving as rigorously as possible, but also recognize the limitations of such an endeavor for the problems under consideration. Therefore, they increasingly use semiempirical models, and derive arguments from the behavior of experimental results. This is done with mastery, because the reader achieves to recognize, which problems can be treated on first principles and modeled analytically, which ones are partly understood on a semiempirical basis, and which ones still await investigation and solution.

The quality of writing and editing is excellent throughout the book. However, people looking for an overview of research literature may be disappointed. The lists of references are, indeed, relatively short—mainly due to the authors own publications and on some other classical articles. This is not an accident, but a deliberate decision clearly announced in the preface. Most importantly, it does not jeopardize the comprehensiveness of the work, which may not be comprehensive in quotations, but is comprehensive in topics, problems and solutions. The book is comprehensive also in terms of potential applications to drying, imbibition, granulation, coating, instantization and boiling. People working on respective processes and products for the chemical, life-science, paper and printing, health and home care, or mining industry, will profit from a look at the entire book, and will also find chapters and sections of specific interest to them.

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AIChE Journal, Vol. 54, 3037 (2008)

DOI 10.1002/aic.11637
Published online September 29, 2008 in Wiley InterScience (www.interscience.wiley.com).