

Preface

Why colloidal, why not nano?

This question, recently raised after a presentation of my research, suddenly reminded me of my academic beginnings and that my relation with colloids had lasted much longer than I was aware of before. Certainly, there are objective reasons for my persistent use of the term *colloidal*, even though the term *nano* may sometimes attract a larger audience. Most of all, the both terms are not congruent. With regard to particle size *colloidal* covers a wider range than *nano*, whereas *nano* refers to a wider spectrum of products and applications (e.g. surface structures or nano-electronics). Moreover, *nano* has also non-technical connotations, which may provoke expectations beyond the scope of my research. Yet, in principle the question was justified. Regarding the material systems I usually deal with both terms could have been equally employed. In the instant of that question I realised that I have been fond of colloidal systems since my first scientific steps.

My first encounter with the field of colloid science occurred during my undergraduate studies, when I worked in a project on the electroacoustic zeta-potential measurement of colloidal suspensions. I probably did not understand much of the measurement technique, but I became fascinated with colloids for several reasons. First, they behave “strangely”—at least for a student of process engineering whose education in physics stopped right after mechanics and thermodynamics. Second, in our library I found some of the historical papers by Smoluchowski and others, which impressed by their age and the clear and comprehensible explanation of the physical phenomena in colloidal suspensions. Further on, I felt attracted by the interrelation of physics, chemistry and engineering. Last but not least, there was this mystery that our curriculum completely ignored the subject of colloids.

I remained stuck to the field of particle characterisation when I started my scientific career at the Technische Universität Dresden. In particular, I dealt with the ultrasonic attenuation spectroscopy and its potential use for process characterisation. The performance of this sizing technique was to be examined for colloidal systems. I soon learnt that there is no meaningful particle measurement without a

profound understanding of the material's physico-chemical properties. This holds particularly true for colloidal systems, which are prone to aggregation and agglomeration. A proper characterisation, therefore, needs to address the questions of sample stability, signal interpretation in the case of aggregated suspensions, or the description of aggregate morphology. These are not just academic issues, but were and are still addressed in several projects that our research group has conducted for industry partners (e.g. in the semiconductor industry, or in pigment manufacturing) or legal authorities (e.g. with regard to nanotoxicology). For me it was, hence, a logical step to expand my research focus from the characterisation techniques to the physical behaviour of colloidal particles and aggregates. This book reflects a major part of my research in this field.

I have been working in the university for more than 15 years. I would like to acknowledge the opportunities that this environment has offered for my scientific work. On the one hand, there are the manifold contacts to industry or other research groups, which ensure a certain variety of scientific topics as well as the confrontation with different views and new aspects. On the other hand, there is enough room to deeply explore scientific problems, which is essential for really moving forward in science. Besides this, the university life offers the chance to go on sabbaticals, which I was able to use for short-term stays at the Ecole Nationale Supérieure des Mines in St.-Etienne/F and at the Doshisha University in Kyoto/JP. Both stays clearly widened my views (not only on colloids) and gave substantial input to my research. At this occasion I would like to thank Frédéric Gruy and Yasushige Mori for their logistic support and our scientific discussions.

Of course, I also took advantage of the university environment while writing this book. Its content is definitely influenced by the experience I gained in several research projects and, naturally, I could profit from the expertise of my colleagues at the Research Group of Mechanical Process Engineering. I gratefully acknowledge their scientific as well as non-scientific support. Indeed, I really appreciate the family atmosphere I can work in. Special thanks are dedicated to Michael Stintz, the head of our group, for his principal support, his helpfulness and his professional advice. Last but not least, I sincerely thank Margrit Hansel for being our "firewall" against bureaucracy, and even more for her respectful manners and her extraordinary kindness.

In addition, I want to acknowledge all the students and Ph.D. students who contributed to my research through literature research, experiments, programming, discussions or publications. Especially I would like to mention Uwe Kätzel, who wrote an exceptionally good diploma thesis on the scattering of aggregates, subsequently worked in our research group, and eventually submitted an excellent Ph.D. thesis on the characterisation of pyrogenic silica with dynamic light scattering. Additionally, I would like to appreciate the outstanding theses of Karin Schwarzenberger (née Schießl) on the subjects of aggregate scattering and aggregate interaction. Even though she conducted these works as a student, they were of remarkably high quality and provided a sound basis for future investigations. Last but not least, I want to acknowledge the input of Karina Paciejewska, who received a doctorate on the stability of colloidal suspensions under my supervision. I was

able to benefit from her intuitive understanding of colloidal phenomena, her experimental work, and all the inspiring discussions. Most of all, I thank her for our close friendship.

Further thanks go to Lee-Ellen Reed who subedited the manuscript and gave valuable assistance in finding the best English expressions.

Finally, I would like to thank my family, which has always shown its support for me and my scientific work and which provides me with the positive emotions that are needed for accomplishing a monograph like this.

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