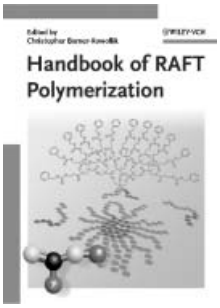
Handbook of RAFT Polymerization



By *Christopher Barner-Kowollik*, Wiley-VCH, 2008, hardcover, 544 pages, 169 €, ISBN: 978-3-527-31924-4

The Handbook of RAFT Polymerization is a comprehensive compilation of Reversible Addition-Fragmentation Chain Transfer (RAFT) based chemistry that consists of twelve chapters plus an introduction written by 25 experts in RAFT including the inventors of the technique.

The unprecedented advances in controlled polymer synthesis that the last 20 years have been witnessed are largely due to the discovery of controlled radical polymerization (CRP) techniques. Among these techniques, the RAFT process, discovered in 1998 by researchers at CSIRO in Australia and almost at the same time by French researchers at CNRS, appears as one of the most prominent although it is the most recent one. The reasons for the significant adoption of the RAFT process by polymer chemists are mainly due its high tolerance to functional monomers and its large synthetic potential for the construction of complex macromolecular architectures. As a result the research interest in RAFT has constantly increased since 1998.

Although several review articles have already been published, the present book is absolutely not redundant and each of the authors under the guidance of the editor have accomplished an invaluable and considerable work of putting together with both rationale and rigor individual chapters, starting with modelling and kinetics considerations (*Chapters 2–4*), to move to radical chemistry of thiocarbonylthio compounds (*Chapter 5*) and their implications in RAFT bulk or organic solution (*Chapter 6*), in aqueous solution (*Chapter 7*) and in heterogeneous media (*Chapter 8*). *Chapters 9 to 13* are more oriented towards the generation of complex macromolecular architectures.

The first half of the book (*Chapters 1–8*) accurately provides the reader with all the kinetic data, the chemistry, and the different conditions under which the RAFT process can be conducted together with more than 150 references per chapter. Although C*hapters 2 to 4* may remain difficult to access for the non-physical chemist – at least from a purely synthetic polymer chemist's point of view – they provide an encompassing picture of the kinetics and the modelling advances that have been made to understand the hidden complex and not yet fully understood mechanism of the RAFT process. *Chapter 5* is a real immersion into the origins and the developments of the thiocarbonylthio derivatives. This pure radical chemistry part, which is generally not considered too much by polymer chemists who usually take advantage of the established synthetic pathways available to reach thiocarbonylthio compounds of interest, will probably help the reader to understand how the transfer of knowledge from organic to polymer chemistry has achieved and resulted in such a powerful CRP technique. Having gained the theoretical knowledge of the process and knowing how thiocarbonylthio compounds can react with radicals, the reader is now fully armed to understand which RAFT agents have been synthesized for which type of monomers to polymerize and under which conditions, points that *Chapter 6* addresses. It was then important to underline one particularly redeeming feature of the RAFT process which relies on its tolerance to water. *Chapter 7* is especially dedicated to the application of RAFT performed in water. RAFT agent stabilities are first discussed prior to addressing the suitable monomers polymerizable under such conditions. Those include ionic, zwitterionic and non ionic monomers, with a separate section dedicated to biologically significant sugar-containing family of monomers. The natural continuation of this part of the book is the extension of the aforementioned RAFT feature to RAFT polymerization performed in aqueous dispersed media. After a brief but sufficiently detailed description of the main types of heterogeneous free radical polymerizations, *Chapter 8* is dedicated to RAFT polymerization performed in emulsion (*ab initio* or seeded), mini or microemulsion or by precipitation in the presence of surfactant and finishes with surfactant free processes, an area of increasing interest which has recently been enriched by very recent results on the use of solvophilic macroRAFT agents in dispersed media.

In each of the aforementioned chapters, the authors manage to focus on their respective guidelines without being tempted to discuss the myriad of architectures that are accessible via the RAFT process.

With these chapters in mind, the reader can now safely tackle the remainder of the book which is devoted to the syntheses of macromolecular architectures. *Chapters 9* focuses mainly on block, comb, stars giving details related to the choice of the monomers, the conditions and/or the strategy to reach such architectures. While *Chapter 10* could have been placed after or before chapter 6 to illustrate the Macromolecular Design by Interchange of Xanthate (MADIX) process – essentially identical to RAFT from a mechanistic point of view – it nicely reviews and discusses the strengths and particularities related to this process. Surface particle modification using RAFT is subsequently discussed in *Chapter 11* according to grafting to and from

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approaches, the latter including the anchorage of the initiator, the Z group or the R group onto the surface. The features of the resulting materials are then discussed in terms of surface structure or interfacial properties in nanocomposites. End functionalization and end modification of polymer chains obtained by the RAFT process can generate several types of polymers which were not previously described and this is the focus of *Chapter 12*. The attractions of these polymers include the possibility to switch from RAFT to another polymerization technique in order to isolate for example block copolymers of mechanistically incompatible monomers. Eventually, a last chapter, *Chapter 13*, is a nice compilation of examples for which materials prepared by RAFT can or do find applications in a number of specific fields. Emphasize is put on bio-related fields but fluorescence and optoelectronic properties as well as modifications of organic or inorganic substrate are also discussed.

As the first handbook on a controlled radical polymerization technique, the Handbook of RAFT Polymerization is a very good support for the expert, an excellent tool for the newcomer to the field and will additionally and undoubtedly serve as excellent educational material that will supplement free radical polymerization and macromolecular design teachings.

Franck D'Agosto
Villeurbanne (France)

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