

Gächter/Müller

**Plastics
Additives**

4th Edition



Plastics Additives Handbook

**Stabilizers, Processing Aids,
Plasticizers, Fillers, Reinforcements,
Colorants for Thermoplastics**

4th Edition

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Plastics Additives Handbook

Preface to the Fourth Edition

The third edition of the Plastics Additives Handbook sold out completely within three years, a very clear indication that this book is needed and appreciated by the plastics community.

Not much has changed during this period in the technology of plastics additives. However, major changes are evident in the market scenario. The publishers thus decided not just to reprint the third edition but to correct errors and update the Index of trade names, manufacturers and suppliers. So this fourth edition is actually not a revised edition with major changes but is composed of the text of the third edition with an updated index of suppliers for each group of additives. Our thanks to the authors for their help and advice.

The Editors

Spring 1993

Preface to the first edition

The vigor of the plastics industry remains unbroken but there has been a shift in emphasis with regard to technical development. Today front stage is occupied by the development of plastics and plastics systems, tailor-made for specific applications.

Along with copolymers and physical blends of various plastics, additives are enjoying a key position within this new trend in development. They permit the use of plastics in applications where the plastics material as such would have had small chance of success.

Additives are accepted today as full-fledged partners of plastics. In this sense, this Additives Handbook is a logical and long overdue complement to the trade literature. The Additives Handbook is a reference book having as objective to summarize the state of the art achieved in this area. Next to this somewhat static point of view, attempts have been made to present an outlook of the future, whenever relevant technical trends could be discerned at this time. It is hoped in this way to stimulate further, in depth collaboration among plastics producers, plastics processors, and additives manufacturers. This in turn should lead to long term meaningful problem solutions, thereby further strengthening the position of plastics materials in technology and the economy in general.

In view of the diversity of the subject matter, it was deliberately decided not to have one single author treat the vast topic Additives. Instead, a number of authors qualified by their professional activity, are attempting to describe how additives contribute to rendering thermoplastic polymers – the scope of the Handbook is limited to them – capable of fulfilling their manifold purposes.

The individual chapters of the Handbook are structured essentially in an introductory outline of the technical/commercial aspects of the problem, followed by a short synopsis of the corresponding physical and chemical fundamentals. The subsequent main part deals with the various products or product groups and their use in individual plastics. The already mentioned future outlook forms the concluding part.

The penultimate chapter of the book is concerned with toxicological problems faced daily by additives producers and users alike. The increasingly more severe requirements imposed by the authorities on additives for approval of their use in plastics in contact with food, exert profound influence on the future development in this area. A short résumé of this problem complex appeared, therefore, appropriate.

Already two German editions have been published of this Additives Handbook, which has become an indispensable reference to all those who are professionally connected with the complex world of additives for thermoplastic polymers. Readers' responses have clearly shown that it helps fill a real gap in the trade literature.

The present English version complies with numerous wishes from all sectors of the plastics industry. Apparently a broad and comprehensive survey of additives is missing from the extensive English literature on plastics. The English text corresponds to a great extent to the latest German edition, only minor changes and linguistic adaptations have been made by the authors of the various chapters.

In this connection we should like to thank particularly Dr. *Peter Klemchuk* for his valuable contributions in preparing a technically and grammatically correct translation.

Basel, Switzerland, November 1984

R. Gächter
H. Müller

Preface to the third edition

The continuing interest in and the acceptance of the *Plastics Additives Handbook* by plastics technologists made it necessary to prepare this third English edition. There are several reasons for this: On the one hand, the second edition found its buyers rather quickly; on the other hand, within recent years new developments have appeared in the field of polymer additives which are worthwhile reporting, and many of them are already widely used. This is true, for example, for the rapidly increasing number of tailor-made stabilizer systems being offered for various plastics and their many applications. In the area of light stabilizers, the sterically hindered amines (HALS) have gained in importance quite considerably, both in the number of products available and in their fields of application. The potential of their effectiveness as thermal stabilizers is not yet fully exploited. Another important development concerns the fact that preconditions for the regulation of additives for plastics food packaging are getting more and more severe.

Since nothing is as constant as change, the reader will note some changes also in the third edition compared with the second. Several authors of the preceding edition have changed to other fields of work or have retired; fortunately, qualified authors could be found to revise those chapters. All chapters have been either thoroughly up-dated or rewritten completely; the latter is true for the chapters antioxidants, plasticizers, lubricants, impact modifiers, flame retardants, and antistatic agents.

In view of the ongoing development of engineering plastics and of high-strength plastics composites, it was deemed appropriate to include a special chapter dealing with fibrous reinforcements: glass fibers, carbon fibers and aramid fibers. Since the problems of detection, identification and quantification of plastics additives are of increasing concern for users and health authorities, a chapter on the analysis of additives was also added. The symbols for plastics used throughout this book follow essentially the guidelines as given in DIN 7728 part 1, 1988, DIN/ISO 1629-1981, ISO 1043/1-1987, and ISO 1629-1976 (E). Since some of these symbols may be not familiar to all readers, they are compiled in the Appendix.

The editors would like to thank all "old" and new authors for their competent cooperation and their willingness to invest so much time and efforts in their contribution. In particular, we are indebted to Dr. Peter Klemchuk for his invaluable work as associated editor for this edition

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and the preceding ones. One of us (H.M.) would like to express his sincere gratitude to Mrs. M. Chappuis who was extremely patient and helpful with the mountains of paperwork involved.

Basel, August 1990

R. Gächter
H. Müller

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Dr. F. Gugumus, Basel, Switzerland

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