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Measurement Uncertainty in Analysis of Plastics

Evaluation by Interlaboratory Test Results

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Preface

Technical and scientific results should include information about measurement uncertainty. This statement is largely undisputed today, although such information is still missing in many documents. But how is the measurement uncertainty evaluated? The authors have learned from experience that analytical laboratories often shy away from time-consuming calculations for economic reasons, but also because of the complexity of the subject matter. Instead, they prefer an approximate estimate of the measurement uncertainty based on their experience, especially since the accreditation bodies of many countries accept such approaches. On the other hand, there is a great willingness to participate in interlaboratory comparisons. Such studies are considered very useful because one's own results can be compared with those of other participants. In addition, the results provide a valuable basis for measurement uncertainty.

There are also many laboratories that are confronted with changing questions, materials and analytes day after day and are always under time pressure. The authors have worked in such non-routine laboratories for a long time and some of them still do. It has been their experience that the available guidelines do not provide help in determining measurement uncertainty because the necessary data from long-term quality assurance are missing and precision data from interlaboratory tests cannot be found. Therefore, results are usually reported without measurement uncertainty or, at best, in the form of a rough estimate. To increase the amount and variety of precision data available, the authors organized interlaboratory tests in the field of plastics for more than two decades. Most participants were from industrial laboratories and performed the tests under daily conditions. The commitment of the laboratories resulted in a lot of data that has not yet been fully published.

The aim of this book is to make the collected data available, together with other precision data published in literature and standards, thereby facilitating the estimation of the measurement uncertainty in plastics analysis and, finally, to show how different measurement results should be interpreted using the uncertainty data. The easy-to-understand theoretical part of the book first introduces measurement uncertainty, followed by a description of how this uncertainty can be calculated from interlaboratory test results. An entire chapter is devoted to the question under which conditions a difference between two results is significant. In the main part of the book, the data found up to the end of 2021 are grouped thematically, presented graphically or in tabular form, and discussed in the accompanying text. Some different analytical methods dealing with the same measurand are compared under the aspect of measurement uncertainty. Examples at the end of the chapters show how the data can be used in everyday industrial applications.

The present book is primarily a translation of the German edition "Messunsicherheit in der Kunststoffanalytik – Ermittlung mit Ringversuchsdaten" (Uncertainty of Measurement in Plastic Analysis – Determination with Interlaboratory Test Data), which was published by Carl Hanser Verlag in 2017. Feedback from some readers about the lack of such an overview in English encouraged the authors to translate this book. The English version has been updated and expanded to include new findings and results from the literature and standards where appropriate.

The authors would like to thank the many laboratories in Europe that participated in the interlaboratory tests with a high level of expertise and thus made the book possible at all. The Swiss Federal Laboratories for Materials Science and Technology Empa provided us with a set of unpublished interlaboratory test data; many thanks for this. A special thanks is due to Dr. Petra Wampfler. Petra has contributed much to the understanding of Chapters 2 and 3 with her critical questions and useful hints. Last but not least, we would like to thank the Hanser Verlag for their constructive support, especially Dr. Mark Smith for editing the manuscript and proofreading the English translation, Melanie Lindwurm-Giordani for checking the manuscript and page proofs, and Conny Speckmaier for her production work on this book.

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