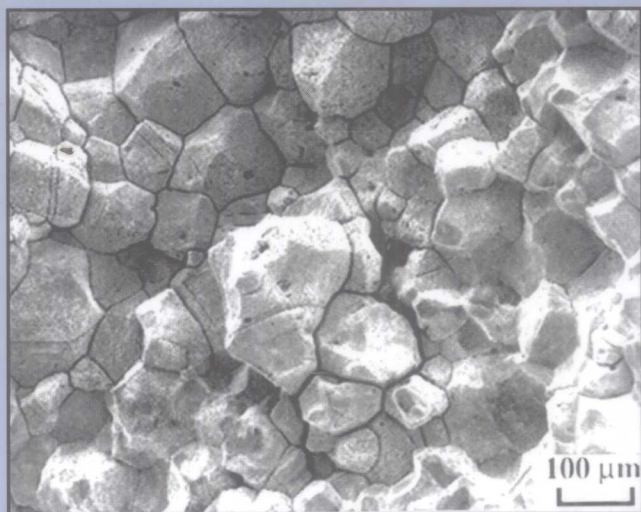


# **Practical Engineering Failure Analysis**



**Hani M. Tawancy  
Anwar Ul-Hamid  
Nureddin M. Abbas**

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# Preface

Failure of engineering structures in industry can cause loss of life, unscheduled shutdowns, increased maintenance and repair costs, and damaging litigation disputes. To prevent future recurrence of the problem it is essential to carry out an investigation aimed at deterring the root cause of failure. The results of the investigation can also be used as the basis for insurance claims, for marketing purposes, and to develop new materials or improve the properties of existing ones. The treatment of this subject is therefore important in order to develop preventive measures minimizing the incidence of failure and reducing their associated cost to industry.

All engineering failures, without exception, occur at the weakest link in the design–fabrication–performance chain of a product. The ability to identify this weakest link and propose remedial measures is the key for a successful failure analysis investigation. This requires a multidisciplinary approach, which forms the basis of this book. An important feature of this book is that it not only demonstrates the methodology for conducting a successful failure analysis investigation, but also provides the necessary background. Different stages in the life cycle of an engineering product, encompassing design, fabrication and

performance in service, are explained. Factors that can influence the ability of a product to fulfill its functional requirements during service are discussed.

The background needed to conduct a successful failure analysis investigation is developed in this book by introducing important principles of materials science and engineering. Basis principles of fracture mechanics and stress analysis are also elucidated. Various mechanical properties and the tests required to measure them are described. Both macroscopic and microscopic characterization of materials and their relevance to the field of failure analysis are discussed. This knowledge is then used to develop the procedure for a thorough failure analysis investigation. Finally, several case studies covering failures related to processing of materials, design, manufacturing, and service conditions are classified according to the type of industry and included to serve as examples. Within this context, the difference between the mode of failure and cause of failure is emphasized.

It is hoped that this book will provide the reader with the tools required to reach a sound conclusion about the cause of component failure and will provide proper recommendations for preventive measures. Because of the legal implications of failure analysis investigation, the use of proper technical terminology is emphasized throughout the text.

It is our pleasure to acknowledge the support and encouragement received from King Fahd University of Petroleum and Minerals through the Research Committee. The first author is greatly indebted to his wife. Without her unflinching support and encouragement, this project would not have been possible.

*Hani M. Tawancy*  
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*Nureddin M. Abbas*

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