Textiles in automotive engineering

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Mike Hardcastle

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Dedicated to my forebears, Taishan County, Guangdong Province, China

Walter Fung
(Feng Qing Xiang)

To Christine my wife whose unflappable character, cheerful disposition, patience and constant support have provided the inspiration for my contribution to this publication and many other enterprises.

Mike Hardcastle

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Preface

In preparing this textbook, it has been the authors' objective to provide a work of reference and instruction to all those involved with textiles in the automotive industry. Textiles are present in many forms in the automobile ranging from the seats to battery separators, from headliners to bonnet liners. The automotive textile industry requires knowledge of several disciplines, textile chemistry, fabric technology, plastics' science, production engineering and interior fabric design. The latter, which has become more important in recent years, combines artistic talent with textile technology. Some information is available in specialist trade journals but there is shortage of literature and especially textbooks dealing with the subject as a whole. This book is intended to plug that gap and cuts across all the disciplines involved.

The book is written in a concise, simple style which it is hoped can be understood by anyone with only a basic scientific background knowledge. The scientific principles are explained to help readers understand why processes are done in such a way, and it is also hoped this will assist with problem solving. Because of the practical nature of the industry, all technical, design and manufacturing personnel are frequently referred to as 'engineers'. It is hoped that this book, while containing some scientific theory and some history to make it more readable, will be of practical help to all automobile engineers who deal with components containing a textile and also to interior trim designers.

Today the technical requirements of performance and durability of interior trim fabrics, often seem to override all other considerations such as colour design and texture. However it must not be forgotten that the original driving force for the widespread use of textile fabrics and structures in car interiors during the early 1970s was to expand the design and colour potential of the car interior, which aesthetically had become fairly dull and uninspiring. An attractive interior trim is now regarded as a major aid to sales and model differentiation. The different textile production methods of weaving, knitting and printing all come with their own particular advan-

tages and features, but also with limitations regarding the design and colouration achievable. The importance of all of these aspects, which concern both the fabric supplier and the car manufacturer, is fully explored in this book.

In the face of very severe competition, the automotive industry worldwide is undergoing intensive and wide-ranging restructuring. At present cost is the major driving force in development as a whole. New processes are being introduced to make components more quickly and more economically. Frequently they involve processes and conditions, usually applied to more heat-resistant plastics, which are adapted to process textiles which are less heat resistant and have delicate surfaces and texture. Examples are the newer moulding processes now being used for door casings, seats, and other interior trim. Sometimes the operatives and even supervisors involved have no comprehension of what conditions the textile will withstand in terms of temperature and pressure. The result is many rejects which can be detrimental to the factory involved and to the industry as a whole. This book should help by explaining the physical limitations and other properties of the textile.

Car makers, known as Original Equipment Manufacturers (OEMs) are becoming assemblers of outsourced components or modules made by their direct suppliers, the so called Tier-1 companies. When Henry Ford invented the production line his warehouse always carried 4 months of spares so that the production line never stopped. Today, the efficient OEM has virtually no warehouse but relies on just-in-time (JIT) deliveries of components. This necessitates the Tier-1 suppliers' production to be always right up to schedule. In turn the production schedules of the suppliers to the Tier-1s must also be on time. Severe financial penalties may be imposed by the OEMs, if production lines are held up. This situation demands that any production problem must be quickly identified and put right.

Frequently the past history of the textile has contributed to a particular fault and it is very important that the quality engineer is familiar with the previous process, which the textile has already undergone, to solve that problem – and better still to prevent it happening again. In addition, the quality engineer should be fully aware of the process conditions his own customer will subject the material to, so that he can be sure that his own process is not likely to cause problems further down the production chain or for the ultimate customer, the car purchaser. This book should be invaluable to the quality engineer in these activities to improve quality and efficiency and hence profitability.

The book should also be of use in universities and colleges for both students and research workers, who now have all the relevant information in one textbook, together with numerous literature references, refer-

ences to test methods and a glossary of unfamiliar terms and abbreviations. A detailed list of technical and professional organizations, journals and recommended conferences are also presented for keeping up to date.

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