Woven Fabric Engineering

edited by
Prof. Dr. Polona Dobnik Dubrovski

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Preface

Woven Fabrics are flexible, porous materials used for clothing, interior and technical applications. Regarding their construction they posses different properties which are achieved to satisfy project demands for specific end-use. If woven fabrics are to be engineered to fit desired properties with minimum production costs, then the relationship between their constructional parameters and their properties must be first quantitatively established. So a great attention should be focused on woven fabric engineering, which is an important phase by a new fabric development predominantly based on the research work and also experiences. For the fabric producer's competitiveness fabric engineering is the important key for success or at least better market position.

Nowadays, a great attention is focused on the fastest growing sector of textile industry, e.g. technical textiles, which are manufactured primary for their technical performance and functional properties rather than their aesthetic or decorative characteristics. Technical woven fabrics are used in a large number of diverse applications such as protective clothing, in agriculture, horticulture, finishing, building and construction, filtration, belting, hygiene, automobiles, packaging, etc. Woven technical fabrics are also the reinforcement component in engineering material no.1, e.g. composites, which offer significant opportunities for new applications of textile materials in the area of aerospace, defence, construction and power generation, land transportation, marine.

The main goal in preparing this book was to publish contemporary concepts, new discoveries and innovative ideas in the field of woven fabric engineering, predominantly for the technical applications, as well as in the field of production engineering and to stress some problems connected with the use of woven fabrics in composites.

The book is organized in five main topics and 20 chapters. First topic deals with the Mechanical Properties Engineering. For technical applications the mechanical properties of woven fabrics are one of the most important properties. Many attempts have been made to develop predictive models for mechanical properties of woven fabrics using different modelling tools and to define the influence of woven fabric structure on some mechanical properties. This topic includes six chapters dealing with: prediction of woven fabric tensile strength using design experiment, artificial neural network and multiple regression (chapter 1), prediction of plain fabric elastic properties using finite element method (chapter 2), woven fabrics tensile properties modelling and measuring (chapter 3), the influence of biodegradable yarns (bamboo, polylactic acid, soybean protein) on mechanical properties of woven fabrics (chapter 4), experimentally verified theory of identification of stages of cotton fabric by static tearing process (chapter 5), and the data base system of the fabric structure design and mechanical properties (chapter 6).

The second topic is focused on Porous Properties Engineering. Woven fabrics are porous materials which allow the transmission of energy (electromagnetic radiations: UV, IR,

light,etc.) and substances (liquid, gas, particle) and are, therefore, interesting materials for different applications. The chapters involved within this topics cover: the theory of flat textiles porosity and the description of a new method for porosity parameters assessment based on the air flow through the flat fabrics (chapter 7), the modelling of air permeability behaviour of woven fabrics using artificial neural network method (chapter 8), and the theory of the UV protective properties of woven fabrics with the emphasis on the influence of woven fabric geometry on ultraviolet protection factor (chapter 9).

The woven fabric surface unevenness prediction and evaluation (chapter 10), detection of woven fabric faults by morphological image processing (chapter 11), and the research dealing with the surface properties of PES fabrics on the basis of chromatic aberration and dynamic wetting measurements (chapter 12) are discussed within the third topic Surface Properties Engineering.

The forth topic of the book deals with the Textile Production Engineering, where the use of microwaves by finishing processes (chapter 13), basic properties and advantages of coated fabrics with woven component as substrate (chapter 14), and the importance of the cloth-fell position (chapter 15) are discussed.

The last topic Textile Composites Engineering involves the contributions dealing with mostly woven fabrics as reinforcement phase in polymer composites. It comprehends the characteristics of natural fabrics in composite ranging from mat to woven fabrics (chapter 16), crashworthiness investigation of polyamid composite crash boxes with glass woven fabric reinforcement (chapter 17), the influence of the immersion time in different environments (water, natural seawater, detergent/water liquid) on some mechanical properties of E-glass woven fabric reinforced polymer composites (chapter 18), the investigation of weight loss of composites with glass woven fabric reinforcement as well as with aramid fibres reinforcement (chapter 19), and simulations of composite reinforcement forming (chapter 20).

The advantage of book Woven Fabric Engineering is its open access fully searchable by anyone anywhere, and in this way it provides the forum for dissemination and exchange of the latest scientific information on theoretical as well as applied areas of knowledge in the field of woven fabric engineering. It is strongly recommended for all those who are connected with woven fabrics, for industrial engineers, researches and graduate students.

Editor

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