Chapter 15
Electrotexiles: A Novel Product for the Textile Industry

Georgios Priniotakis
TEI of Piraeus, Greece

ABSTRACT

During the last decade, the textile Industry in Europe collapsed due to the competition with the low labor countries. The textile industry in Europe refused to adapt to the new market conditions. The competitive advantage of the design and the quality were not enough to keep it in the leading position. Nevertheless, in the last few years, the textile industry has completely changed. New products have been launched in the market. Electrotexiles is one of them: a new category of textile products that has conducting properties contrary to the traditional textile products but keeps the “textile” properties like softness, lightness, and “washableness.” Fabric is the best intermediary between the human being and a computer. Fabrics and cloths are almost all the time in contact with our body. Therefore, they can “feel” us and “cure” us. A fabric can also cover a large space, having low weight and cost, so it could be perfect if it can have electrical properties and work as photovoltaic. This chapter explores electrotexiles.

1. INTRODUCTION

Electrotexiles are a novel category of textiles. Textiles offer a unique way to fabricate novel large area, flexible clothing for use in military, medical and commercial systems. There is a unique research and development in basic yarn components, textile circuits, device manufacturing CAD and device simulation, fabric based system simulation, design and modelling for that reason. This includes a very important condition to talk about “Electro” textiles, which is the possibility to conduct an electrical current. In this section different methods will be discussed to produce such fibres, yarns and garments (Seyam, 2003).

However, electro-textiles are not expected to compete with high-density, high-performance electronic systems typified by current computer of telecommunications products because of higher resistance, thus slower charge transport (data transport). Electro-textiles can have other unique applications that are determined by the need of flexible and conformable systems or systems that require large surface areas. Distribution of elementary sensors, actuators, logic, and power sources combined with reconfigurable network
architecture with fault tolerance and operational long-term stability is needed. It is expected that lower production cost for these types of applications will be achieved through the use of textile manufacturing processes that are appropriately modified and optimized to incorporate electronic components (conventional or yarn based).

Textiles structures are characterized by their high strength, flexibility, and conformability to almost any desired shape. They can be manufactured continuously at high speed with extremely low production cost. Textiles structures are produced and used in forms such as fibres, yarns, twisted structures, braided, woven, knitted, non-woven, or a combination thereof. They can be modified and structured with piles, spaces and multi-layers to accommodate inserts and devices. They exist everywhere around us in many forms. There are numerous end uses of textile structures for small surface areas (such as apparel, seat covers, and seat belts) large surface area (such as rugs, parachutes, weather balloons, and parafoils) and exceptional large surface areas (such as carpets, wall covers, houst wraps, geo-textiles, scientific balloon, air structures and tensioned structures). It is the aim to develop electro-textiles that keep the advantages of conventional textiles but allow charge transport through its structure.

2. ELECTRO-TEXTILE STRUCTURE AND PRODUCTION METHODS

There is a wide variety of structures in electro-textiles, which are mainly based on the technology used to produce such fibers.

- Production of pure metallic fibres. The structure is the one of the metal and charge conduction is obtained through the entire fiber.
- Metallization is a process in which a metal ion is absorbed by a conventional fibre, followed by chemical reduction of the absorbed metal ions to its metallic phase. In this case also conduction is obtained through the entire fibre but with a limited rate, dependent of the density of metal ion absorbed in the fibre and adsorbed at the surface of the fiber.
- Chemical deposition, is the method that conductive materials are deposited through chemical methods, thus the conductivity properties are obtained exclusively at the surface of the fibre.
- Inclusion of conductive material, such as carbon particles, during melt spinning production of the fibres.

Fibres obtained by these methods are then further manufactured in yarns, clothing and garments. The production methods are described more in detail in the sections below.

2.1. Melt Spinning Process

One of the cost and process effective methods is blending common plastics with conductive fillers, such as carbon black, metal powders, during the melt spinning production of fibres. The method is not still optimised. There are several efforts to develop conductive fibres with melt spinning process. (Ikkala et al., 1995) described the development of conductive polymer blends by blending thermoplastic bulk polymers such as polyolefins, polystyrene or a polyaniline salt complex. In their report 1-20 S/cm of conductivity has been achieved in the range of 1-30 wt% of the polyaniline complex. (Kim et al., 2004). have prepared conductive composite fibres by mixing polyaniline emeraline salt, polypyrrole and graphite with polypropylene or low-density polyethylene using a co-rotating twin-crew extruder. Low polyaniline concentrations (6-10 wt.%) were used for polyaniline particles dispersion in Polypropylene via melt blending.

Dall’Acqua reported the development of conductive fibres made by cellulose-based fibres
6 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the product's webpage:

www.igi-global.com/chapter/electrotextiles/113661?camid=4v1

This title is available in Advances in Marketing, Customer Relationship Management, and E-Services, InfoSci-Books, Business, Administration, and Management, InfoSci-Business and Management, InfoSci-Select, InfoSci-Select, InfoSci-Select. Recommend this product to your librarian:

www.igi-global.com/e-resources/library-recommendation/?id=101

Related Content

Social Media as Political Participation Tool Among Millennials: An Applied Research on Egyptian Social Media Users

www.igi-global.com/article/social-media-as-political-participation-tool-among-millennials/214504?camid=4v1a

An Integrated Framework for Sustainable Schools

www.igi-global.com/article/an-integrated-framework-for-sustainable-schools/152205?camid=4v1a

An Ecological Originated Design in Education Structures: A Case Study of an Education Campus in Adana, Turkey

www.igi-global.com/chapter/an-ecological-originated-design-in-education-structures/115180?camid=4v1a

Internet Marketing and Consumers Online: Identification of Website Attributes Catering to Specific Consumer Intents in a Digital Paradigm

www.igi-global.com/article/internet-marketing-consumers-online/69979?camid=4v1a