

WOODHEAD PUBLISHING SERIES IN TEXTILES



# Textiles in sport

Edited by R. Shishoo



The Textile Institute

**WP**

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For protective sportswear, spray rating is more important than it may first seem because coated or laminated fabric with poor spray rating will wet out very quickly and could shorten the product's life. Water will 'pearl off' a fabric with a good spray rating, meaning that the coating has less work to do, and, moreover, breathable fabrics are believed to lose some breathability when the fabric and coating is 'wet out'. If a water repellent is applied correctly, an initial spray rating of 100% is achieved quite easily, but maintaining this over a long period of time requires care, especially during garment cleaning. Washing with a detergent could reduce spray rating because any residual detergent will act as a wetting agent for rain. Soiling and abrasion occurring during wearing will eventually reduce water repellency but this can be refurbished to a certain extent by application of products sold by Nikwax and Granger.

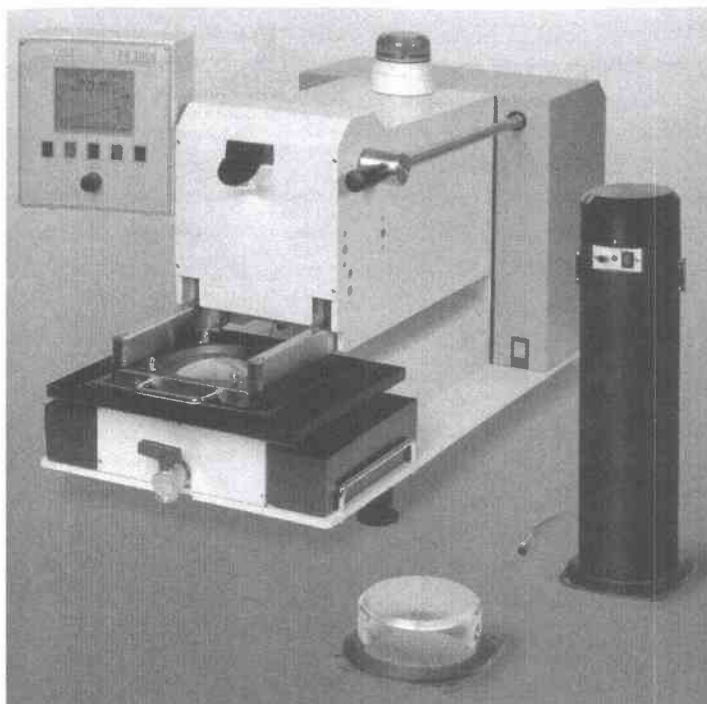
### 8.7.1 Testing for waterproofness (water resistance)

The term 'waterproof' should be used with caution because it implies that the material is completely impermeable to water penetration. 'Water resistant' is now encouraged as being more realistic; however, 'waterproof' is still widely used. The unit kPa is gradually being used more in place of cm (head) of water; 10 cm is equivalent to 0.98 kPa, or 100 cm is equivalent to 9.8 kPa. The 'parent' BSI standard for coated and laminated fabrics is BS 3424, which has 25 parts; the equivalent in the USA is ASTM D 751-98 comprising 90 paragraphs. BS 3546, with its revisions and additions, deals with waterproof protective clothing for different uses. Waterproofness is assessed using a hydrostatic head tester, which in effect tries to force water through the coated fabric sample and measures the pressure used as the height, or head, of a column of water. For many years, 100 cm was regarded as the minimum for a fabric to be classed as waterproof, but now quality garment manufacturers require at least 200 cm, and even 600 cm after durability tests may be demanded by some manufacturers. Figure 8.6 shows a modern hydrostatic head tester.

To simulate wear and tear over a period of time, durability tests are carried out on the test sample before measuring water resistance. These can include abrasion (usually assessed by a Martindale test machine, see Fig. 8.7), flexing (Schildknecht), crumpling (combined flexing and twisting) and washing under various methods. Some allowance is usually made for water resistance after these tests – it is not expected to be the same as it was before durability testing. Some customers will accept 60% water resistance retention, but others, such as the Ministry of Defence, require 700 cm after all durability tests.

### 8.7.2 Breathability

Testing for breathability – the ability to transmit water vapour perspiration – is significantly more involved than testing for water resistance. Breathability may



8.6 Modern hydrostatic head tester (FX 3000 Automatic Hydrostatic Head Tester 'Hydrotester 111' by Textest AG), for measuring water resistance of coated fabric. Water drops penetrating through the test fabric are automatically detected and so continuous operator attendance is not required during testing. Source: Photograph reproduced by kind permission of Textest AG of Zurich, Switzerland.

be expressed in terms of 'water vapour permeability' (WVP) or 'moisture vapour transport resistance' (MVTR). The units are grams of water vapour transmitted through a square metre of the material over a 24 hour period ( $\text{g/m}^2/24 \text{ hr}$ ). Water-resistant and breathable fabrics have been in existence at least since the early 1970s, when W L Gore and Associates introduced Gore-Tex, but there are still a number of methods of test in use and not everybody is convinced that they relate to what is experienced in actual use.<sup>71,72</sup> Methods based on the evaporation of water through the test material, the so-called evaporative cup methods, based on the American Standard ASTM E 96 methods, are quick to carry out and non-skilled personnel can relate to what is happening. However, evaporative tests are significantly influenced by test conditions and in fact the ranking of different products can be changed by selection of test parameters. Understandably, manufactures have tended to favour tests which show their own product amongst the leaders. Studies have been carried out to compare the various methods, and development continues.<sup>72,73</sup>



overall waste reduction from all sectors of industry. Textiles represent about 2% of domestic waste, and coated materials are probably only a small fraction of this. Composting is being encouraged, and to this end the Composting Association in the UK has launched a new 'compostable' logo.<sup>97</sup> At the time of writing, local authority councils are on course to meet overall targets of 17% for 2003/4.<sup>98</sup> However, the UK is far behind other European countries such as Denmark and Germany.

## 8.9 Future considerations

Globalisation and the import of coated and laminated fabrics into the UK and EU are likely to continue to reduce prices, and therefore for profitability, and indeed for survival, the coating and lamination industry must both develop new products and reduce costs of production and raw materials. At present, European and American machinery and chemicals manufacturers are amongst the world leaders, and opportunities exist for sales of these items and associated apparatus in the Far East and to countries where manufacturing is flourishing due to lower labour rates. Many companies have chosen to move production abroad whilst retaining the design and research departments in the UK. The technology involved in protective sportswear is related to that for industrial protective clothing and to a certain extent healthcare. There could be synergistic benefits by keeping in touch with these areas.

### 8.9.1 New and novel products

Coating and lamination allow the properties of two materials to be exploited in addition to new properties produced as a result of their combination. The processes also allow the exploitation of additional materials in the form of fillers in the polymer coating. Simple examples are fluorescent, high-visibility or reflective materials in fabrics or highly flame resistant materials in fire barriers. In both of these cases, the fabric and coating are merely carriers of the specialist material. More imaginative products may be possible using the same thought process, especially with new materials being produced. The 'filler' could be micro-encapsulated material<sup>99</sup> or even microprocessors of some description, and they may be combined with specialist fibres such as anti-cut yarn, aramid or even carbon fibres. The concept of nanotechnology may offer opportunities for innovation, maybe using nano filler.<sup>100-102</sup> Nano-Care and Nano-Pel fabric protection developed by Nano-Tex, a subsidiary of Burlington Industries, were launched during 2004. These products claim to offer wrinkle resistance and to repel oil and water thus allowing breathability to be maintained throughout the life of a garment.<sup>103</sup>

To increase the scope for recycling, chemical companies are developing polyester polymers which may be used for fabric coating. Developments of this