

## ATTEMPTS TO PRODUCE A THREE-DIMENSIONAL PAPER STRUCTURE

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MR RADVAN mentioned (in the section on page 145 of attempts to produce a three-dimensional paper structure) several different approaches to the attempts at orienting the fibres in the Z-direction with the claim of increasing the bulk. As he also mentioned, this is of the greatest interest in the production of wet-laid non-wovens.

In addition to the method of upending some of the fibres, especially the short fibres and enmeshing them vertically in the web, a further method has been discovered.<sup>(1)</sup> This uses crimped synthetic short-cut fibres in such a way that only a section of a fibre is located in the Z-direction and it is not necessary therefore to upend a complete fibre. Furthermore, this does not involve any after-treatment.

Recently, the Reutlingen Institute for Textile Technology has produced some extremely interesting results, using two-dimensionally crimped polyester and polyamide short-cut fibres.<sup>(2)</sup> Perhaps three-dimensionally crimped fibres may be better, but are at present difficult to get into suspension and therefore require further thorough experimentation.

Former studies showed that the crimped fibres can be processed without difficulty so long as certain conditions are observed—such as an optimum cable tension during cutting, bringing the cut fibres into suspension in the pulper at about 1 per cent consistency with the addition of a suitable special detergent and keeping the consistency in the mixing chest at below 0.1 per cent.<sup>(3)</sup> The filtration resistance of these webs is much lower than normal, probably in consequence of their three-dimensional structure.<sup>(4)</sup>

The Reutlingen experiments are now in progress and will be published at the end of this year. With a furnish of crimped fibres with fibre lengths of up to 12 mm, a count of fibres 3.3–5.5 dtex, a crimp up to 30 per cent and a number of half waves of 100, satisfactory sheet formation was obtained. For binding the web, 20 per cent of cellulose pulp was included.

*Under the chairmanship of Dr H. Corte*

Sheets prepared on the Rapid-Köthen standard sheetmachine had a thickness that was 50–300 per cent greater compared with non-woven sheets made from straight fibres; their air permeability also is higher. From Fig. 1, it seems that the air permeability increases linearly with the crimp. Of special interest for non-wovens is naturally the bending stiffness. In Fig. 2, even the small number of experimental points plotted indicates a clear relationship between

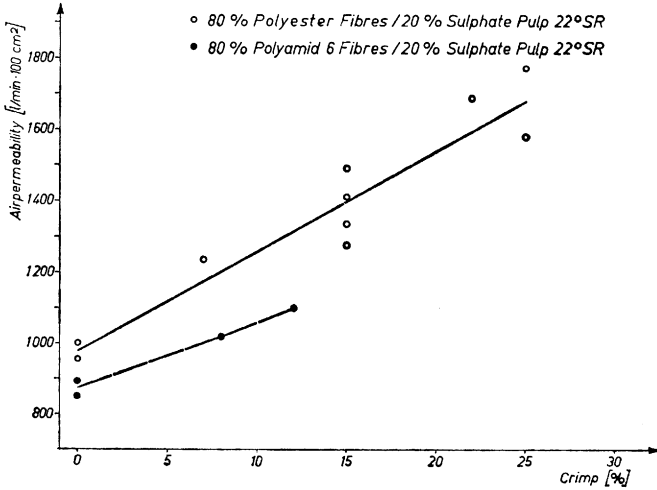


Fig. 1

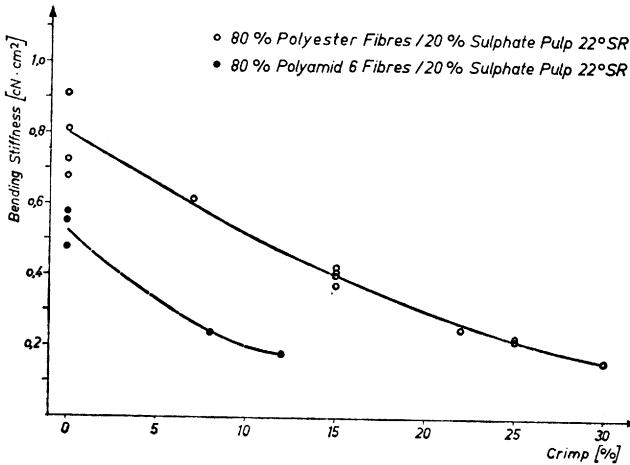


Fig. 2

crimp and the reduction in bending stiffness, which is only 25–50 per cent of the usual values. These results were confirmed by experiments on the Bruderhaus pilot inclined wire at AWETA–BASF, Ludwigshafen.

The reduction in bending stiffness tends to increase drape and can be explained by the following considerations. When the fibre sections are three-dimensionally arranged and the whole non-woven is subjected to bending, the stresses in a fibre are not only tensile or compressive, but may also be flexural stresses. As the specific flexural resistance of a fibre is much smaller than its specific tensile resistance, a greater flexibility results and this imparts a textile-like character to the web, which has up to the present barely been achieved by wet-laid non-wovens.

### **References**

1. Albrecht, W., 'Voluminöse Vliesstoffe nach dem Nassverfahren', XIth International Non-woven Colloquium 1972, Brno, Czechoslovakia
2. Ehrler, P. and Janitza, J., Personal remarks, August 1973
3. Ehrler, P. and Janitza, J., *Melliand Textilber.*, 1973, (5), 466
4. Scholz, B., 'Das Nassverfahren und seine Anwendungsmöglichkeiten', XIth International Non-woven Colloquium 1972, Brno, Czechoslovakia

## Transcription of Discussion

### *Discussion*

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*Mr B. Radvan* May I say first of all that the contributors are to be congratulated, because it is an objective that has been tried before many times, not often with much success. The audience may remember that the Curlator Company, for instance, had a beating machine that claimed to produce curled fibres. More recently, the latency phenomenon in a refiner groundwood was discovered and there again it was found that groundwood fibres that were not allowed to straighten out would produce a sheet that was bulky and soft. There have been many attempts to use crimped fibres. Whether such paper is three-dimensional or not is perhaps an academic question. We are looking forward to hearing of more results.

*Miss Sylvia Schmidt* We made our tests on a pilot machine in a purely practical way (not as an academic question) and we succeeded in obtaining very well formed webs. Later on, laboratory studies were made at the Reutlingen Textile Institute to find out the best way to use these crimped fibres.

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