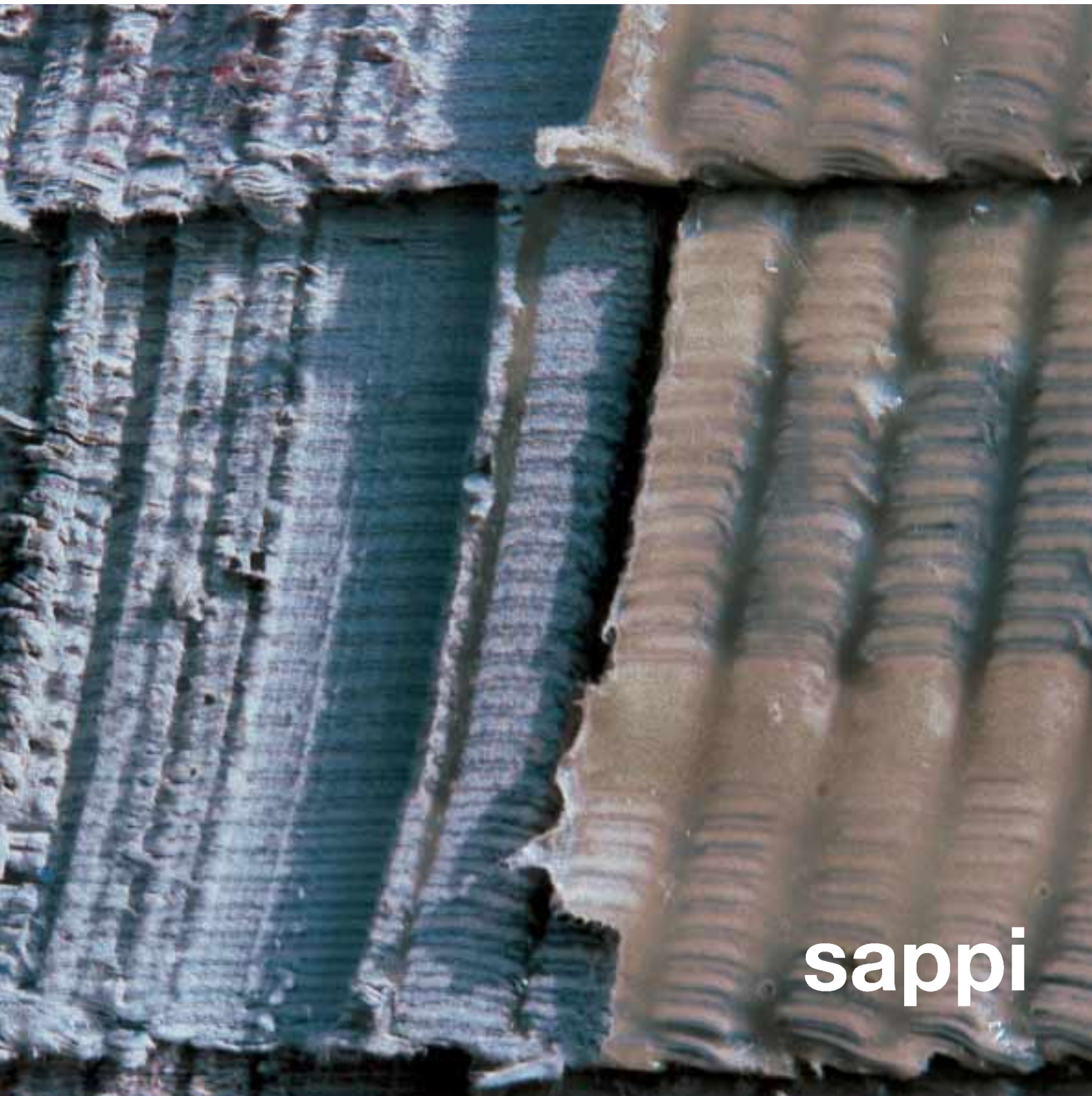
Adhesive Techniques

Developments in the printing and paper making industries and their effect on adhesive techniques in the bookbinding trade



Adhesive Techniques

Developments in the printing and paper making industries and their effect on adhesive techniques in the bookbinding trade

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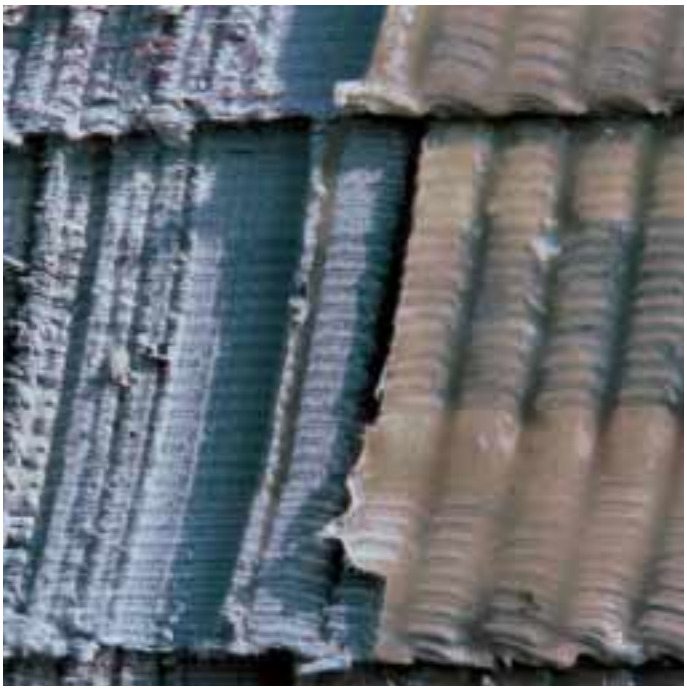

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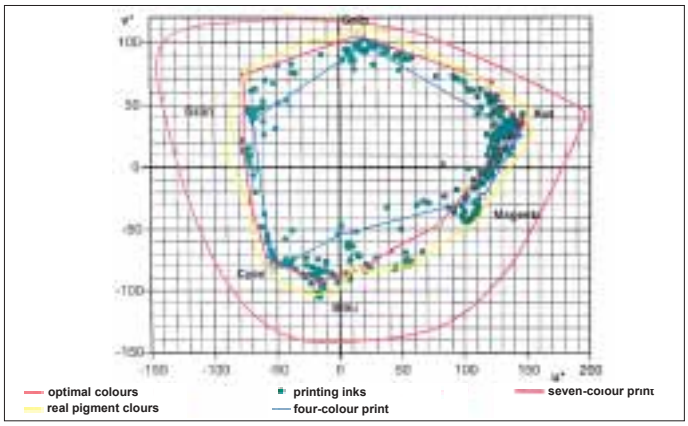

Fig. A *Colour limits in the CIELUV system.*

I Introduction

Nature possesses the greatest and most comprehensive collection of colours, which is only capable of being transferred to a considerably reduced extent. The limited colour shade reproduction of the European Colour Scale represents a challenge to creative activity in order to be able to extend the colour scale in printing technology (Fig. A).

Back-up support is provided by repro or prepress and scanner specialists with new colour shade scales (intensified 4c, 6 or 7 colour shade scales, etc.).

This has had effects on the printing machinery construction industry:
2 and 4 colour printing machines were extended through 6 or 8 colour machines up to 10 and 12 colour printing machines.

These developments are being driven by the printing ink and varnish industry. It is, of course quite natural, that these developments will also have effects upon daily practices. Sappi is lending support to these developments with extensive research, such as “Water Interference Mottling” (a paper presented at the IARIGAI Conference, GATF in Pittsburgh, September 1998 or “Processing of Matt Paper”.

Results have shown, that several peripheral factors exercise great influence, such as for example too much water, the consistency of the water, the printing speed and the number of printing units.

The use of 6 to 12 colour printing machines produces a higher ink coverage on both sides of the paper and this has to be fixed. The printing ink and varnish industry is always seeking to obtain denser applications and/or the same density of ink or superb varnish gloss, by means of thinner applications, respectively.

All these aspects are leading to an optimisation of coated paper surfaces in the direction of triple coatings in order to be able to set and dry the quantities of applied ink and varnish within the shortest possible time.

Sappi with the PM 11 in Gratkorn (Fig. B) is at present the market pioneer with the TRIPLE STAR project. The paper making machinery manufacturers however emphasise, that developments towards greater coating applications will continue.

Fig. B *PM 11 at Sappi in Gratkorn, Austria – the largest fine paper machine in the world.*

II The adhesive binding of triple coated paper

One man's gain could appear to be another man's loss.

In order to obviate such a situation, the following companies have formed a working group under the management of the FOGRA:

The bookbinding machinery specialists	Müller-Martini, Switzerland;
The adhesives manufacturers	Henkel, National and Planatol;
As well as the paper manufacturer	Sappi Fine Paper Europe

The objective of this collaboration was and is to optimise the durability of adhesive bindings when triple coated paper is being used (which involves less fibres and much coating).

Design of Test Runs

In order to obtain reliable results, a large number of sheets was taken from a production batch in each case, so as not to experience distortions and consequential interpretation variables. Around half the number of sheets was printed. A quire of 16 pages of illustration (images) was simulated which was bled off in the binding.

The printing inks employed were:

a) Fresh-type inks;
b) Bio-type inks.

This was to provide a trial to ascertain the suitability of various types of ink for the adhesive form of binding in practice (mineral oil migration from the sheet offset inks).

In addition, papers of the same grammage were employed in every case in the correct run direction for the bookbinder (parallel to the binding), as well as opposite to the binding (incorrect run direction).

The printed and unprinted sheets were folded to form 16 pages (Fig. C) and coloured covers were pre-printed for the respective grammages and run direction (Fig. D).

Fig. C *Printed and unprinted sheets folded to 16 pages. In combination, the printed sheets simulate plates bled off in the binding.*

Fig. D *Coloured covers assigned to the respective grammages of the content paper. Arrows indicate the wrong run direction, i. e. transversely to the binding margin/spine.*

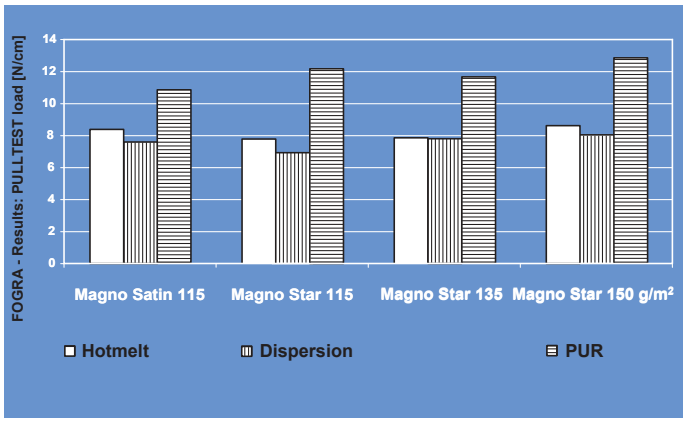

Fig. F *Comparison of glue types:* ***unprinted*** *quires*

This provided sufficient material for the bookbinding trials on the Trend Binder in the Bookbinding Academy in Felben-Wellenhausen, Switzerland.

The tests were carried out in three groups, being the dispersion type adhesive, hotmelt and PUR (polyurethane) types.
The Trend Binder was optimally set up and thus guaranteed the same permanent conditions during the respective series of adhesive application runs. Apart from the adhesive series (and their chemical effects on the adhesive binding) mechanical trials were also carried out with and without Fibre Rougher.

The samples thus bound were drawn in a random sample system and despatched to the Fogra for evaluation.

The following triple coated papers were employed:

Magno Satin* 115 g/m²,
Magno Star 115 g/m²,
Magno Star 135 g/m²,
Magno Star 150 g/m².

Results

The PUR type adhesive binding achieved the highest pull-test parameters with values between 11 and 13 N/cm. Surprisingly enough, the hotmelt and dispersion type adhesions produced practically the same values of approximately 6–8 N/cm, whereby the matt paper of the same grammage provided higher parameters than the high gloss paper (Fig. E).

The high grammage of 150 g/m² yielded relatively the best parameters, which is to be explained by the higher proportion of fibres.

Fig. H *Comparison:* ***Bio-type inks*** *and* ***Fresh-type inks*** *in Hotmelt adhesive binding*

For unprinted brochures the order of sequence for the pull test parameters is (Fig. F):

1. PUR
2. Hotmelt
3. Dispersion

The printed quires produced lower durability parameters with dispersion and hotmelt adhesives (up to a maximum of 1 N/cm less) than the unprinted quires (Fig. G).

** New name for Magnomatt*

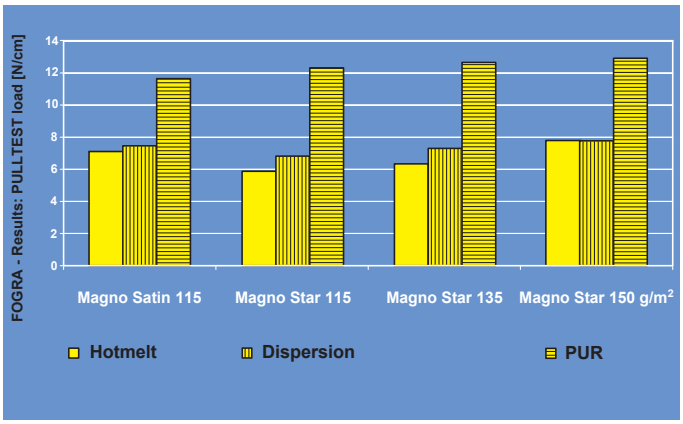

Fig. G *Comparison of glue types:* ***printed*** *quires.*

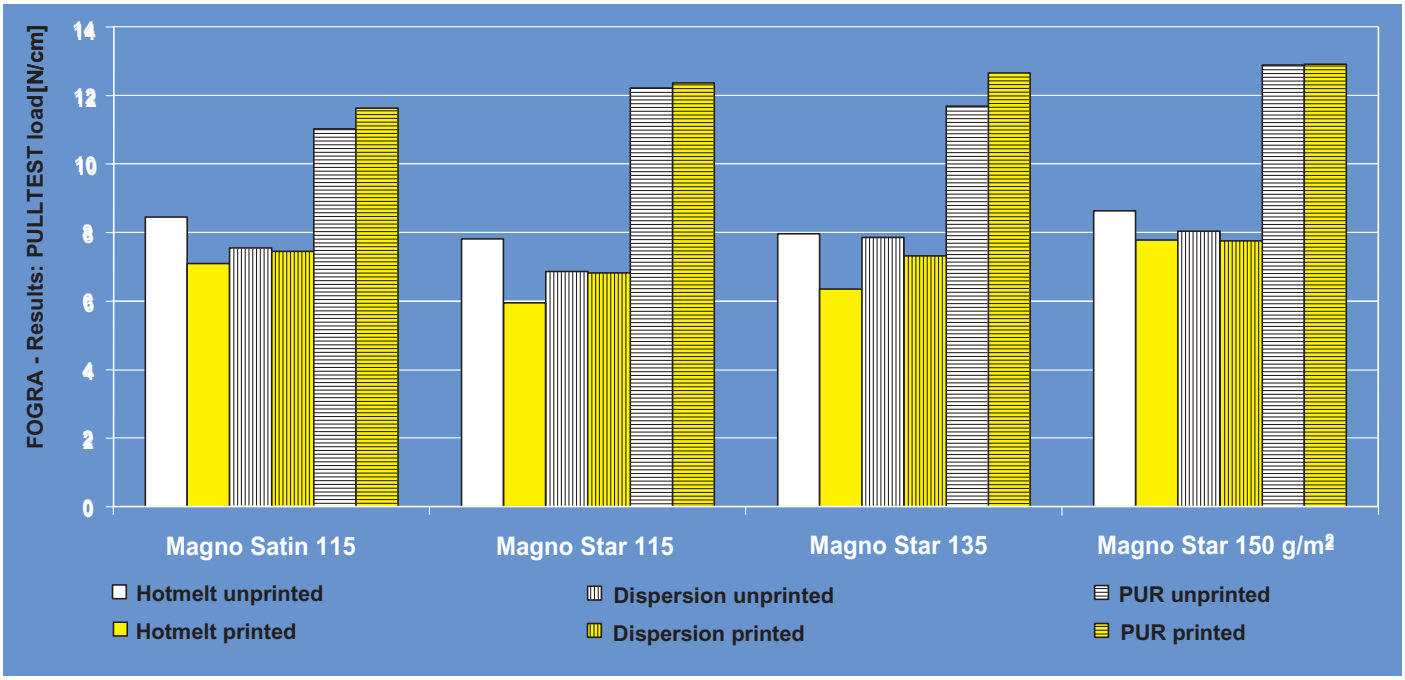

Fig. E *Comparison of glue types:* ***unprinted/printed*** *quires.*

Fig. I *Wrong run direction of the content paper gives the brochure an uneven spine.*

Fig. J *But correct run direction shows a smooth spine for the brochure.*

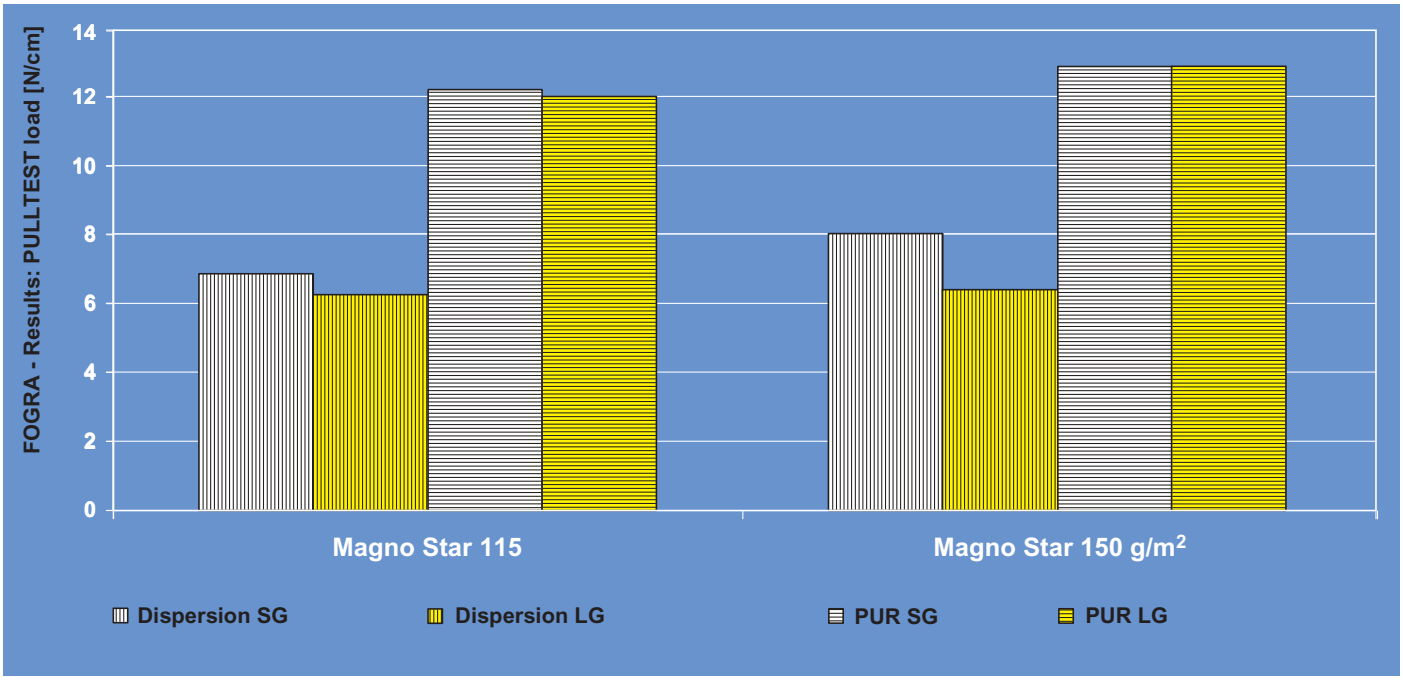

Fig. K *Comparison: SG…short grain, LG…long grain (unprinted papers).*

Fig. H shows the same descending sequence in the comparison between the bio type and fresh type inks with 115 g/m² paper as well as with the 135 g/m² Magno Star paper in respect of

unprinted paper,
bio type inks,
fresh type inks,

and a decrease of around 2 N/cm overall in the durability parameters.

The run direction comparisons in (Fig. I, J and K) indicate that narrow web papers (incorrect run direction) produce lower durability parameters in comparison with the wide web brochures (correct run direction).

The mechanical spine construction is also of importance here, as was able to be demonstrated in the example of the Magno Star 150 g/m² paper in Fig. L. The combination of slight grooving and Fibre Rougher results in an increase of practically 2 N/cm as compared with grooves only and no Fibre Rougher.

Various testing activities in practice with older bookbinding techniques demonstrated greater differences in relation to the results obtainable (Fig. M). This confirms, that improvements are possible with new tools and settings on existing bookbinding machinery in the area of spine processing and adhesive application. Apart from this, insufficient significance is given to such criteria in practice. This should serve as a call to all bookbinding workshop managers to make use of the experience gained and not neglect training, whilst keeping abreast of future developments.

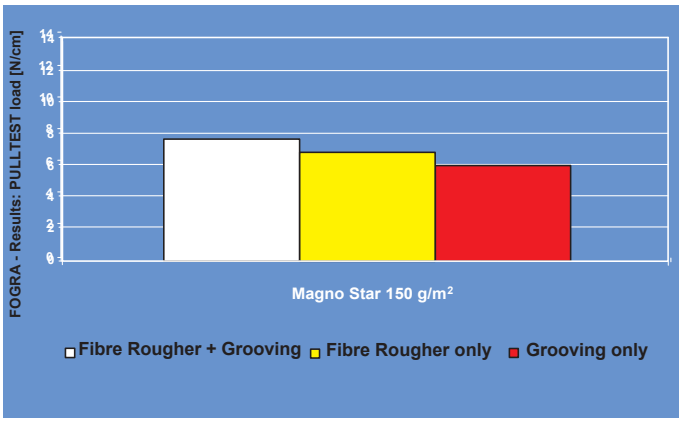

Fig. L *Comparison:* ***Spine processing*** *in Hotmelt adhesive binding (printed brochures).*

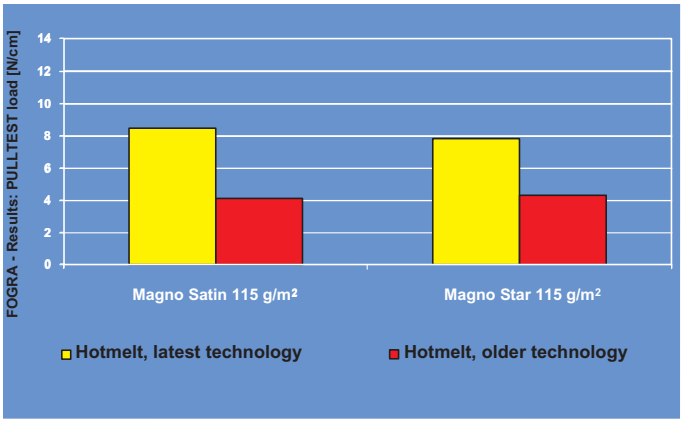

Fig. M *Latest binding technology compared with the practical results of older technologies, unprinted quires, SG.*

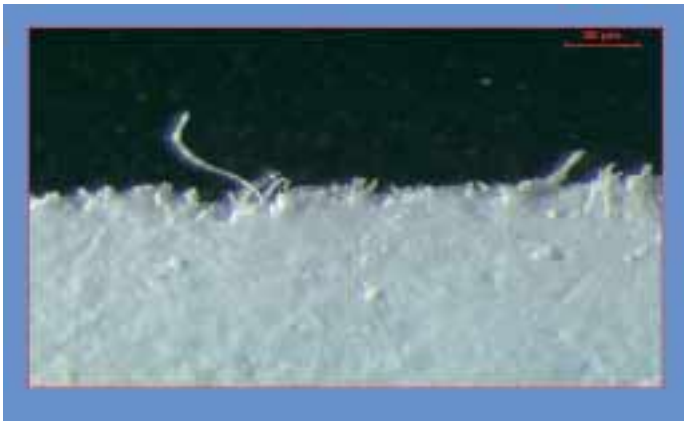

Fig. N *Fine paper treated with levelling tool only.*

III Summary

In the interests of comprehensive collaboration, printed quality brochures should be carefully planned and the paper, printing and bookbinding criteria be taken into consideration, as the printer himself can influence subsequent success or failure at the bookbinding stage.

The following recommendations should be observed for the optimal processing of triple coated paper for adhesive binding purposes:

1. Selection of the correct paper run direction for the bookbinding process, namely parallel to the binding.
2. Matt papers achieve higher pull-test parameters than high gloss coated papers of the same grammage.
3. Quires printed right up to the spine (in sheet offset → Mineral oil migration) create problems for binding techniques (spine processing and application of adhesive).
4. Fresh type inks are more readily available commercially than bio type inks, which on the other hand require more technical attention in print. Fresh type inks result in lower pull-test parameters.
5. The PUR-type binding technique produces the best pull test parameters and a considerably more favourable lay-flat behaviour than the hotmelt process.
6. When difficult processing or machinery techniques are required, and these can, as a result, only be dealt with by means of the available dispersion or hotmelt processes, a particularly careful adhesive binding process will be necessary. This will include: the best mechanical spine processing (with Fibre Rougher) and the most careful application of adhesive in accordance with the instructions of the adhesive manufacturers. This will ensure, that the minimum criteria recommended by Fogra will in any event be obtained and in many cases even surpassed by extremely good results.

The details provided by the results tables were backed up by extremely informative macro enlargements of the spine processing technique and the fusion of the adhesive with the edge of the sheet (Fig. N, O, P and Q).

This is the first time that this analytical research work was carried out on this scale under conditions similar to those found in practice and many thanks are hereby extended to the companies and persons contributing to the project. This collaboration project was successful in demonstrating to bookbinders and printers the possible interconnections in the form of clear-cut test results under this series of trials (Fig. R).

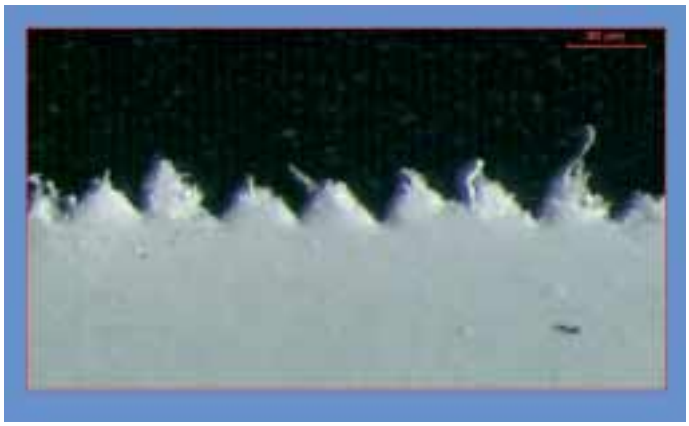

Fig. O *The edge of the sheet was prepared with the Müller Martini Fibre Rougher: the fibres are optimally exposed*

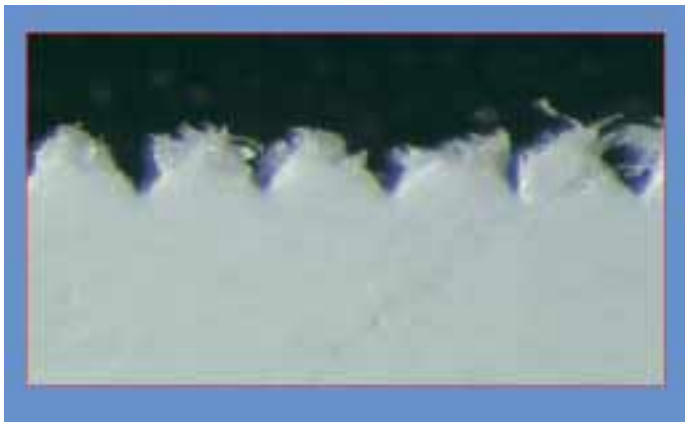

Fig. P *Optimum preparation of the sheet edge with the Müller Martini Fibre Rougher*

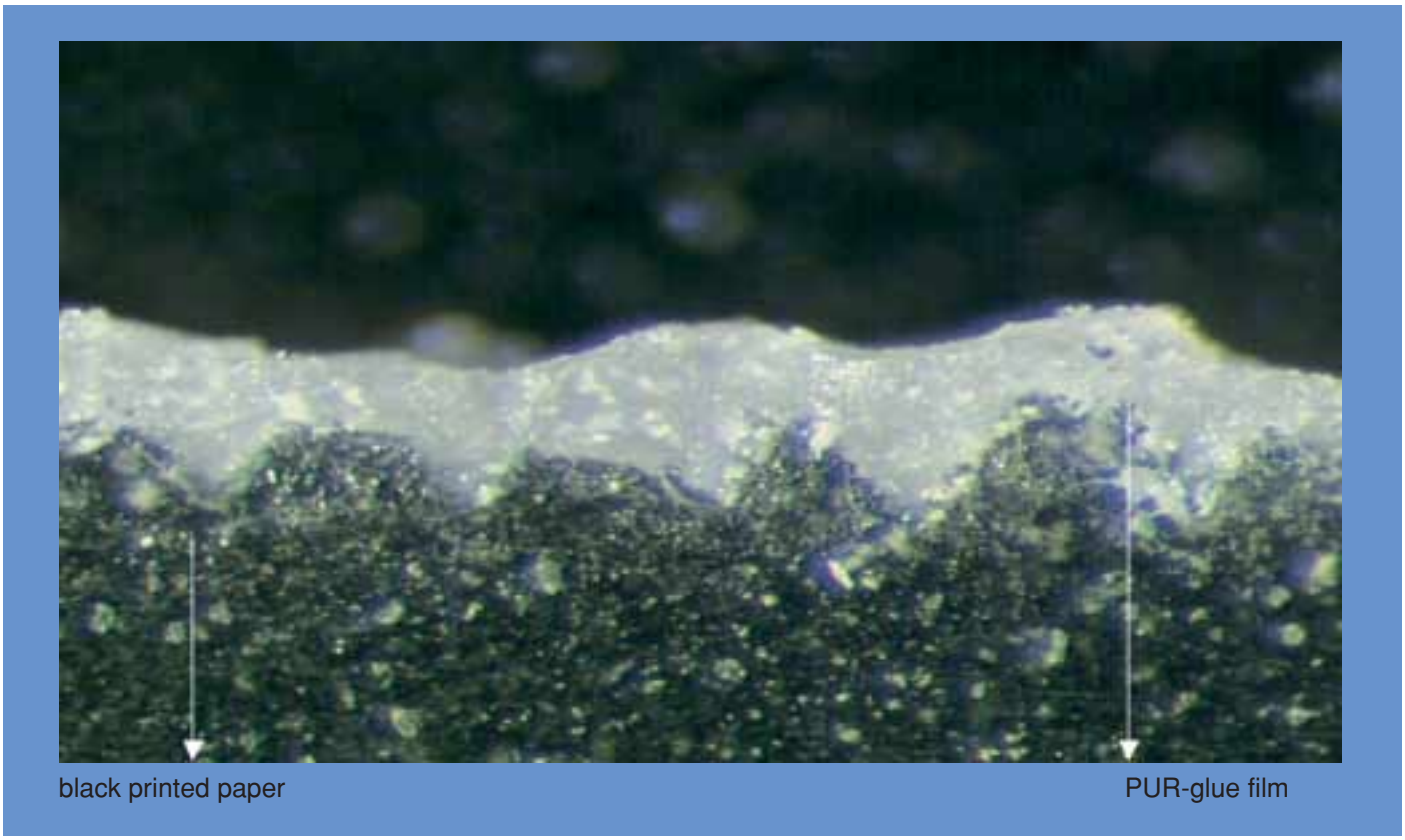

Fig. Q *The excellent glueing, facilitated by the prior preparation of the sheet edge with the Müller Martini Fibre Rougher, is well visible.*

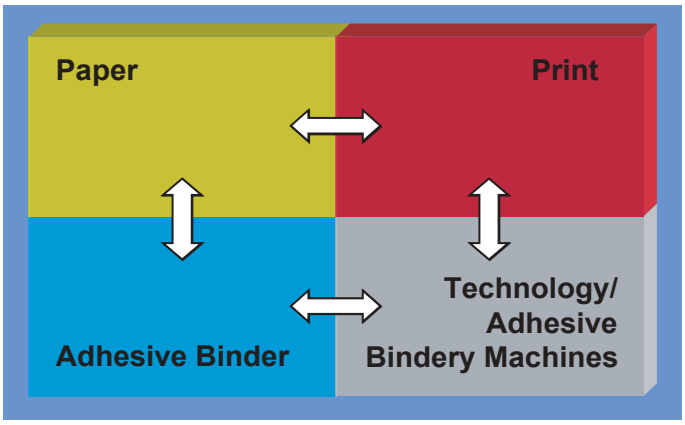

Fig. R *Teamwork in Adhesive Binding Technology*

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