

Effect of Blade on Blade Coating on the Print Results of High Quality Packaging Boards

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ABSTRACT

This paper deals with the latest technology in the field of On-line Coating of Paperboards, with specific reference to Coated Folding Box Board, to achieve the best printability and superior results in the post printing conversions like, over print varnish / lacquer application, UV varnish coatings, embossing, Hot foil stamping etc.

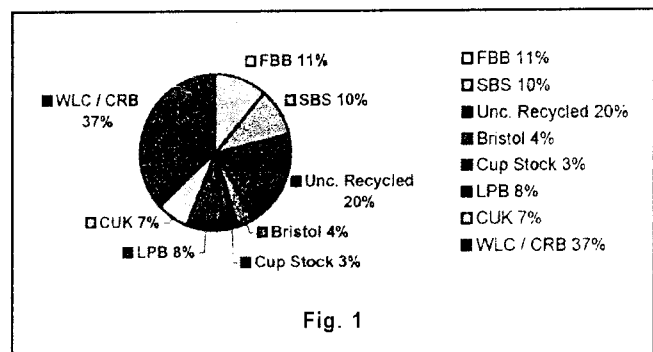
INTRODUCTION

Global Scenario

Ever since the economy is opened up, the regional standards have become the Global standard and in line with the Global Economy. As the Global awareness on the Health & Hygiene, Ecological balance, Environmental friendliness and Global warming is increasing day by day, every sector / industry started having a serious relook on the products manufactured, packed and delivered to the end consumers. As a result of the regulations and FDA guidelines for the direct and indirect contact of food / eatables with the packaging substrates, the growth of the virgin fibre based Solid Bleached Sulphate (SBS) and Folding Box Boards (FBB) has increased substantially in Europe, UK and in the US markets.

The current consumption of virgin fibre based high on quality carton boards for consumer goods is around 21% of the total carton board used in European market. This includes only FBB and SBS grades in (Fig. 1).

As against the European norms, the consumption of similar high quality virgin paperboards in India is significantly low and estimated to the extent of only 6 - 7% of the total carton board consumption. The FBB and SBS are usually preferred for the premium top end confectioneries, Bakery products, Sweets, Ice creams, Fast food snacks, take away meal, coffee and tea packs, Tobacco etc. It is also used in other cultural applications and demand a very superior printing surface to reproduce graphics with sharper and clearer dots while printing. The

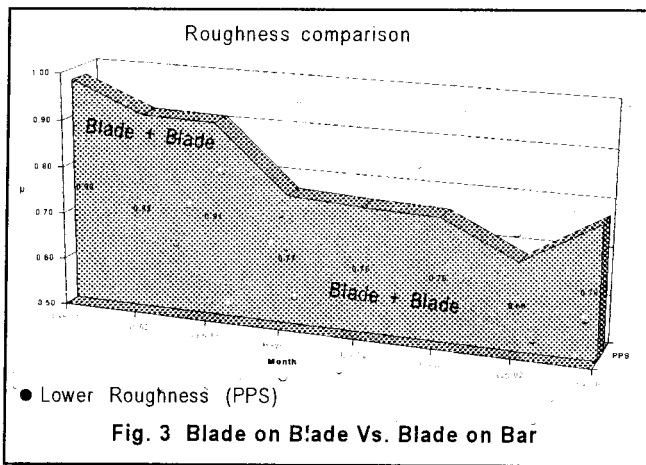
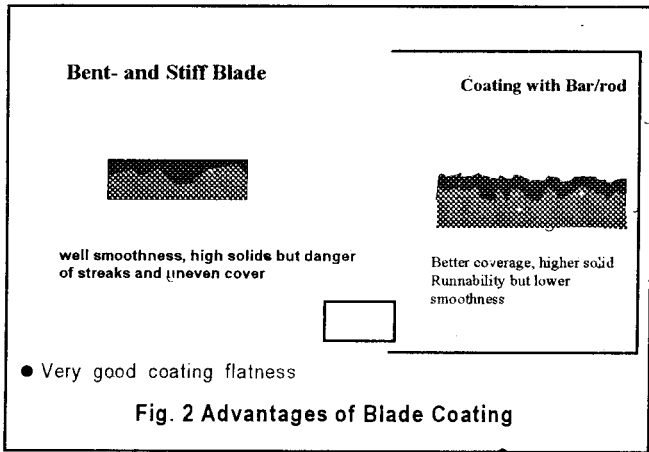


conventional style of coatings with metering elements like rods and the Air knife does not yield the quality of the coated surface required for the end use of these virgin grade boards, in spite of the best coating ingredients and the finishing technology.

To achieve the best flat printable surface, suitable for lithography / offset, Flexography and Gravure printing, one should have the best marriage between the coating ingredients/recipe and the application technology. The blade coating with flexible blades produces the perfectly flat and smooth surface after coating, compared to any other metering elements. However, there are several issues in operating the blade coaters due to various process limitations in most of the paper and paperboard mills worldwide, which will be discussed in this paper.

Coated surface with various metering elements

First of all, the basic difference and the final requirement of the finished products are to be clearly understood. The Air knife coating removes the excess coating applied



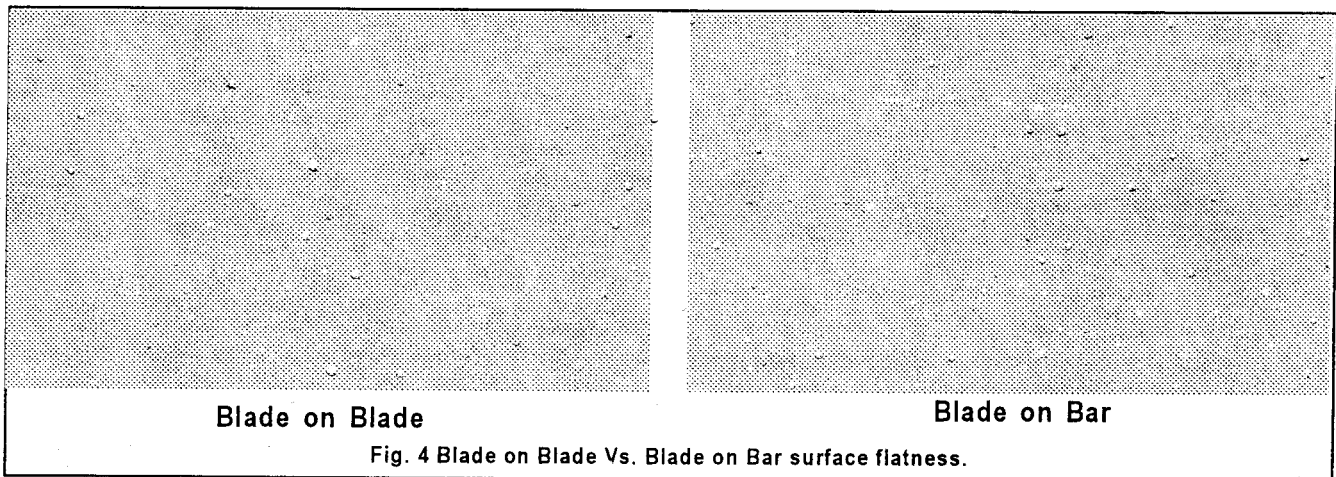
by the air jet uniformly across the width of the machine and results into a very uniform coverage of coating on the substrate. The profile will however follow the contour of the base board surface. The greatest advantage of air knife coating is therefore exploited in the white line chip board, where cleanliness and brightness of the top liner can be improved greatly with the best coverage. Such good coverage is not possible by other techniques of

coating application. The disadvantage of this coater is mainly very high binder migration, as the coating colour is used at relatively low solid content. The roughness of the surface is therefore very high and is not suitable for high quality printing without further surface treatment. It also requires higher energy to dry the coating. The coated surface through air knife, therefore, requires to be supercalendered to achieve the desired smoothness for print result. However, this is done at the cost of bulk and strength of the paper board.

The Metering Bar removes the excess coating by the plain or grooved rod (10-12 mm in dia), rotating in the opposite direction to the travel of the web, results in a semicontour surface. The roughness will be less compared to the Air knife coated surface, but still it needs substantial machine calendaring for better print flatness.

The flexible blade, commonly known as Bent Blade meters the coating while creating an extraordinary smooth surface by pressing the thin blade at an angle over the board supported by the backing roll. The grains and pits of the base board are filled evenly with the high solid coating colour to produce the best possible smoothness of the coated surface (Fig 2).

The roughness in microns as measured in PPS tester is achieved as low as 0.7 microns in the blade on blade coating application. However, coverage is always an issue, hence, it is not a successful application method to be considered as pre-coat when the base board is made with 100% recycled waste paper. In Fig. 3, the roughness of the final board is compared with blade on bar and blade on blade coating process. The roughness of the blade on blade coating is achieved on an average between 0.7 to 0.78 microns as against average 0.9 microns to 1 micron roughness of blade on rod. Though the blade coating results superior surface for the high quality printing, it is to be noted that this is a nonforgiving type of coating process. The web coming for the blade coater should have a very uniform surface smoothness, good overall



formation, uniform moisture across the deckle and finally free from any surface defects. It is a common practice worldwide that the paperboards are coated inline on the machine with multistage coatings for the top and the backside.

There are many Coated Board installations globally with the combination of the Air knife, Rod and the Blade for the topside, however they are mostly confined to the manufacturing of white line chip board (Coated duplex board). The best suggested combination by the experts, based on various trials, is Rod-Blade-Blade for the recycled waste paper based white line chip board and Blade on Blade coating combination is used to produce coated virgin grade boards such as FBB and SBS.

The backside of the board is normally coated with single stage by either rod or blade. Fig. 4 shows the comparative coating surface flatness of blade on blade Vs Blade on bar-coating on Folding Box Board as captured by laboratory camera.

Blade on Rod coating

The commercial production of the FBB was started at Bhadrachalam with the Metering bar at the precoater and the bent blade at the topcoater. Though the results were acceptable for the multicolour offset and gravure printing, the print result was quite different than International quality of FBB and SBS. The indepth analysis of the various surface properties revealed that our FBB and SBS were poor in surface smoothness (roughness), sheet gloss and print gloss, as well as poor in the porometric result. The Helio test values, which measures the missing dots length, was also found comparatively low. The difference in the surface quality while comparing with International boards was quite prominent even after usage of new generation soft nip calender at our end. The table below will show a comparative statement of the optical and surface properties.

Surface Properties of the board with Blade on-Blade Vs.-Blade on Bar in comparison with an International FBB.

Property	Blade on Bar	Blade on Blade	International competitor's Board
Roughness (PPS) μm	0.90-1.10	0.70-0.85	0.80-0.95
Sheet gloss (%) at 75°	52-55	56-58	51-55
Print gloss (%) at 75°	87	91	90
Varnish gloss (%) at 75°	90	96	94
Helio test (mm)	30-38	60-70	30-35
Print Uniformity Index	400-440	480-530	460-500

Helio test in mm indicates the distance till the 20th missing dot is encountered. Higher the length, better the gravure printability

Print Uniformity Index is a measure of the uniformity

of a solid print, higher the number better the print uniformity.

Roughness (PPS)- Lower the value better is the smoothness.

The printing and packaging industry is changing rapidly. The printers and converters are becoming more demanding to receive the best substrate for the most productive and quality result from their printing facilities of high capital investment. We have experienced that, the conventional method of manufacturing coated board would not satisfy the current generation printers, as far as print gloss, print sharpness and print productivity is concerned. The only solution to meet this ever demanding challenge is coating application through blade on blade arrangement, besides the contemporary manufacturing of carton board.

There were many issues to tackle the process of board making from the furnish, wet end, wire table activity, coating formulation and coater head setting for running the Blade at the precoater. The operation of blade coating at the top coater is easier if the coating head is having the facility of autoblade angle setting, though, it is quite expensive.

Blade on Blade coating

Like every other manufacturing operations, blade coating too does face several teething problems. However, scientific approach with right support from the machinery manufacturers-became handy to come out with desired quality at a reasonably short period. The most common problems encountered during optimizing the blade coating operation were excessive blade scratch lines, nonuniform application, patchy gloss after calendaring, print mottle etc.

Most of these problems were attributed to

- Incorrect Rheology.
- Viscosity fluctuations of coating colour.
- Poor water retention of the coating colour.
- Turbulence in the colour.
- Stalagmite formation on the tip of the blade.

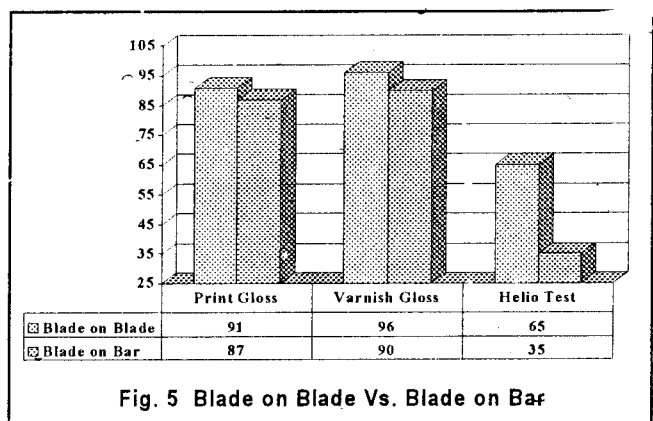


Fig. 5 Blade on Blade Vs. Blade on Bar

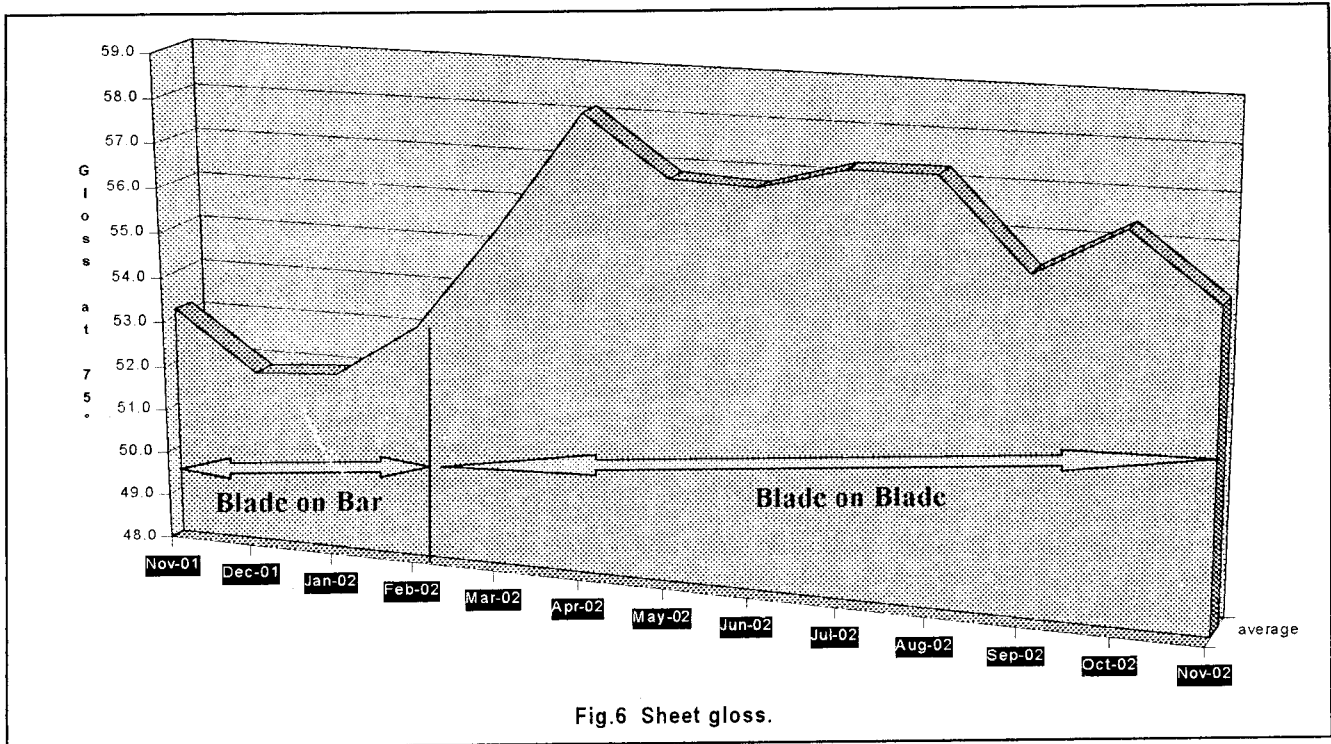


Fig.6 Sheet gloss.

- Poor overall baseboard surface .

These problems have been resolved step by step by the dedicated process control team with the continuous support from the chemical suppliers and machinery manufacturers. The quality of the base board has also been improved drastically by upgrading the forming section of the machine and suitably designed wet end chemistry. This has resulted into a very uniform formation throughout the deckle and the base board free of lumpy formation, which is a prerequisite demand for high quality coated board. With all the actions and efforts put in place, the quality of the bleached virgin fibre based products has come upto the international bench marking standards

The development work is currently being done to further improve the strength properties.

Fig. 5 mat be seen to understand the improvement occurred in the area of surface and optical properties in blade on blade coating application. The enhanced smoothness, gloss and the Helio test results as seen in the above picture acknowledge the coated folding box board of Unit Bhadrachalam being at par with the global standard. The sheet gloss and the post print and varnish gloss have gone up remarkably, which is the basic requirement for a very appealing carton for consumer packaging in (Fig. 6).

CONCLUSION

Blade coating technology is a complex subject , more so

when it is Blade on Blade and in online application . Unlike the offmachine coating, the board makers do not have much time to attend the problems, both at the board making as well as at the coating application end . It is therefore inevitable to depend on reliable instruments and control for the consistent and optimum result. Lot of research is still going on for the metallurgy of the Blade, the application with SDT (short dwell time) and LDT (long dwell time) applicators and the new generation chemicals/additives to make the Blade coating smooth and user friendly.

ACKNOWLEDGEMENT

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REFERENCES

1. Coating training manual of BASF.
2. Various interactions with Mr. Eric Krumbacher Application Engineer , BASF GmbH and Mr. Adrian Wright, Application Engineer of M/s. Dow, Australia during their visit to Unit Bhadrachalam.