Plate/Sleeve/ Plate Making Guide

Corrugated Print's Evolution

Reducing Fluting Issues While Handling Increased Graphic Requirements

Dan Fry

Printing on corrugated media has been plagued by fluting problems from the very beginning. Simply put, fluting is an area of print having higher gain along the tops of the flutes versus in the valleys between them. This print density differential gives the appearance of corduroy striping running along the flutes of the board.

For years, analog printing plates performed acceptably with minimal fluting; however, in the early 2000s the print industry saw the benefits of new digital methods to improve the prepress workflow. This new workflow led to an increase in the use of digital flexo printing plates.

Digital printing plates tend to flute worse than their analog counterparts due to the geometry of the rounded printing plate dot and the edges of type and solids. This rounded surface and the contact angles with the uneven corrugated media contributed to the visual appearance of the printed flutes. As more companies embraced the digital workflow and use of digital printing plates increased, printing plate manufacturers and trade shops had to work closely to reduce the effects of fluting using this new digital process.

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FLUTING FACTOR

To better understand and measure the fluting effect, MacDermid Graphics Solutions created a device that could measure printed dot size across a wide portion of printed corrugated material. When these measured printed dot size readings are plotted, you can easily see the visual appearance of the printed flutes in a graphical chart. This use of a graphical measurement made it easy to identify and measure the difference between the average printed dot size from the top of the flute to the average printed dot size from the valley of the flute.

The difference between these two numbers is what we called the Fluting Factor. The higher the number, the more noticeable the fluting is in a printed piece. If the number is small, it corresponds to a very smooth print appearance and lower visual fluting within the printed piece. *Figure 1* and *Figure 2* illustrate how this matches up with the visual appearance that is seen with the naked eye.

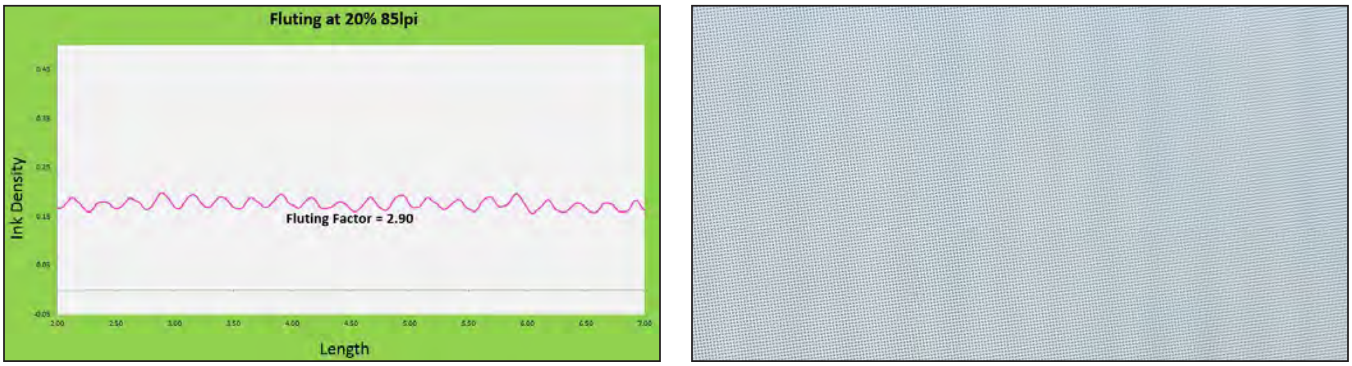


Figure 1: Left, a graph of a printed scan with a Fluting Factor of 2.90; right, printed board with a Fluting Factor of 2.90
All charts and graphs courtesy of MacDermid Graphics Solutions

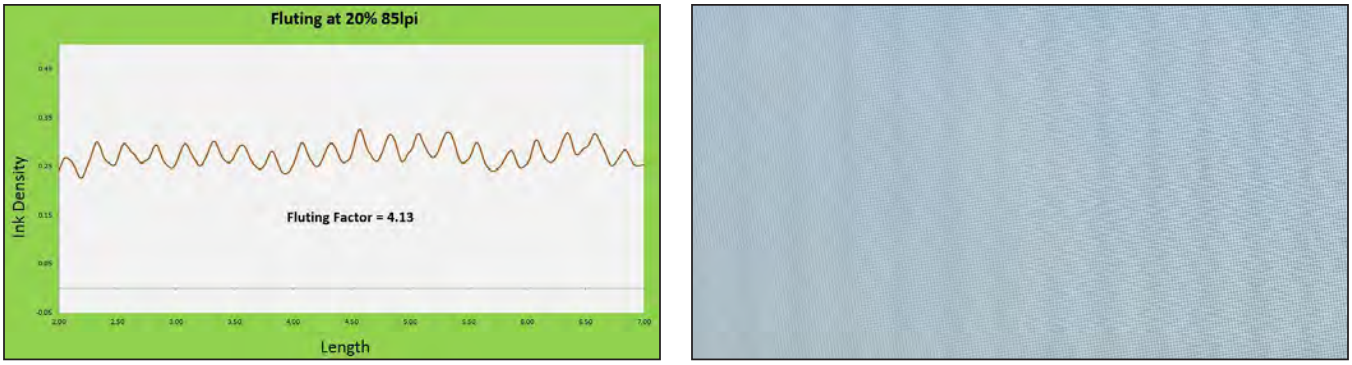


Figure 2: Left, a graph of a printed scan with a Fluting Factor of 4.13; right, printed board with a Fluting Factor of 4.13

Using the information from the Fluting Factor study, a solution (the LUX process) was engineered for digital plates to minimize the fluting effect by laminating a thin coversheet to the digitally ablated printing plate which, after exposure, produced flat printing surfaces.

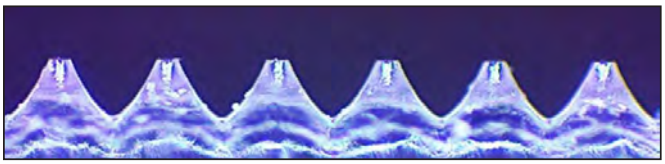
That solution was followed by digital corrugated plates that provide a flat top printing surface right out of the box. Proven results have given plate makers a digital plate with a flat printing surface without the need for additional procedures, equipment or consumables. The plates also offer a new dot shape optimized for even greater fluting reduction and dot gain performance.

This engineered shoulder structure has an angle break in the sidewall of the print character that provides for additional relief from printing pressures to help lower the amount of impression provided to the dot. This pressure reduction helps decrease print gain and eliminates distortions at the media interface while allowing for good surface contact to deliver excellent solid ink coverage.

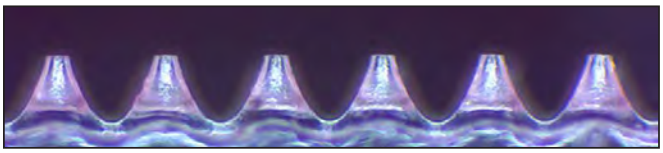
CHANGES IN BOARD

As the corrugated print reproduction market continues to evolve, the industry is looking to save on raw materials without compromising quality. Part of this trend is to down gauge corrugated boards and use paper grades with increasing amounts of recycled content. This comes at a time with increased graphic requirements as the flexo market attempts to grow at the expense of litho labels. Printers and brand owners demand and expect high-quality printing regardless of the board quality.

Conventional digital, 85 lpi at 3 percent



LUX Digital, 85 lpi at 3 percent



Digital DMAF, 85 lpi at 3 percent

The conversion to higher recycled content and lower basis weight boards brings a new challenge to the corrugated printer: how to retain smooth solid ink coverage, print crisp halftones and fine type, while minimizing board crush. The higher recycled fiber content produces a different surface compared to the corresponding virgin liners of the same basis weight due to the additional processing steps needed to prepare the recycled content for reuse.

Attaining good ink coverage on recycled board many times results in the need for additional printing impression to obtain smooth laydown, and that additional impression could lead to board crush. Board crush, if excessive, could lead to structural changes in the printed sheet that then lead to changes in the structural integrity of the completed, folded box.

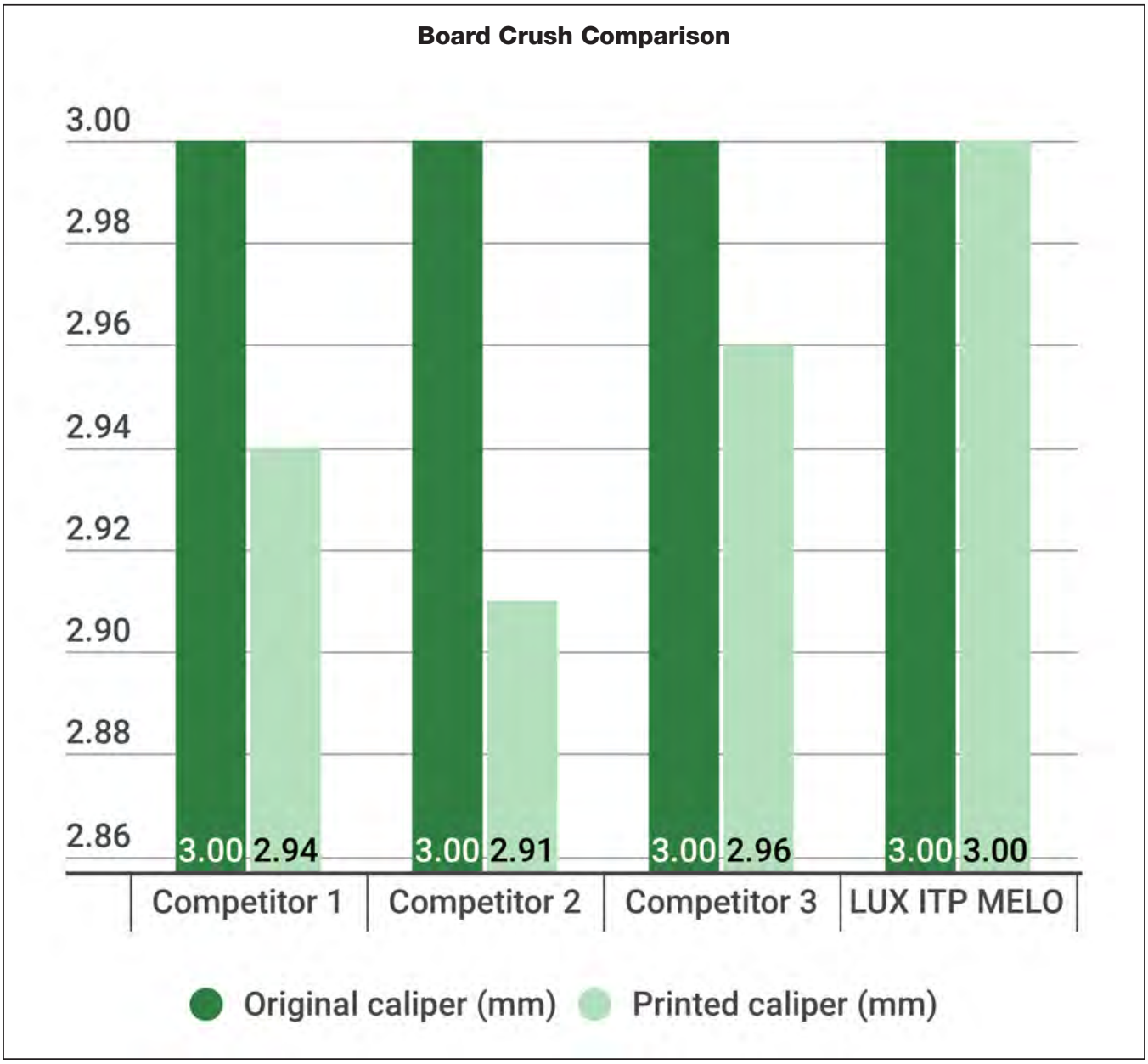
The shift in business conditions highlighted a need for softer plates that offer high graphic reproduction abilities, minimize board crush, use evolving types of corrugated media and provide good solid ink coverage.

> **"Plate manufacturers have introduced liquid corrugated photopolymers designed to offer top protection from the conditions that are typically faced in a corrugated box house, such as ambient UV exposure, heat and humidity resistance, and zone exposure while in storage."**

PLATE ADVANCEMENTS

Plate manufacturers have answered this call with examples specifically engineered as super soft, digital photopolymer sheet plates for use with postprint corrugated board. With out-of-the-box flat top plate technology, they produce printed corrugated results with excellent tonal reproduction and extremely smooth solid ink coverage.

Some of these plates have been designed to hold 1 percent to 2 percent dots at 133 lpi and consistently hold open the 95 percent shadow dots, which eliminate the printer's need to split out plates that have combinations of large solids and fine type or process color within a plate. This allows for additional savings in plating jobs and a reduction in the number of print decks used.



All data courtesy of MacDermid Graphics Solutions

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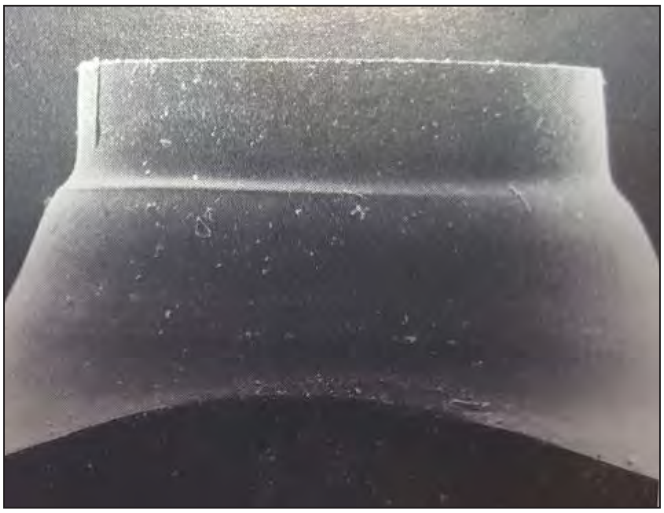
Due to the unique engineered dot geometry, printers are seeing excellent results printing high line process color using such a soft plate. The dot's unique sidewall construction eliminates the typical bulge near the print surface that contributes to excessive print gain or doughnut dots and small type. The softer durometer has also demonstrated improvements in the amount of board crush measured after printing, compared to the typical 32 Shore A printing plates—the industry standard for the corrugated market.

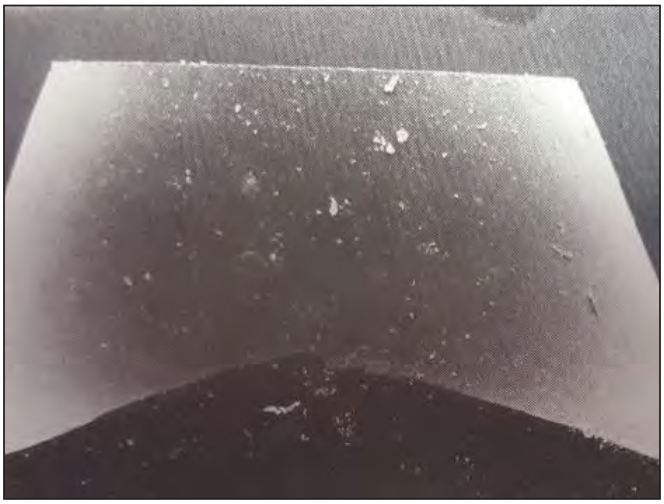
While there has been a significant amount of work and research completed to improve digital plate technology, liquid photopolymer plates are still widely used in the corrugated market and continue to perform extremely well in printing with minimal fluting. To address this, plate manufacturers have introduced liquid corrugated photopolymers designed to offer top protection from the conditions that are typically



Capped liquid plate

Printed board using a capped liquid plate

Printed board using an uncapped liquid plate



Uncapped liquid plate

Capped liquid plate under load

faced in a corrugated box house, such as ambient UV exposure, heat and humidity resistance, and zone exposure while in storage.

PHOTOPOLYMER TECHNOLOGY

For those liquid manufacturers that have not moved into the digital plate making process, there exists photopolymer designed to be used in conjunction with softer materials to provide a straight side-walled, flat-topped printing plate for use with process color and fine type.

Capped liquid plates have always demonstrated the least amount of fluting of any photopolymer plate, due to the flat top printing surface, nearly vertical shoulders and the dual durometer construction of the printing plate. Any distortion from excessive impression caused by press setup or an uneven board surface is handled down the print wall, well away from the printing surface (as demonstrated in *Figure 3*).

As the market moves to create savings using lighter basis weight boards with more recycle content and an increasing expectation of higher and higher print quality demands, flexo printers and plate manufacturers must continue to evolve to meet new challenges in corrugated print. ■

About the Author: *Dan Fry is portfolio manager, corrugated at MacDermid Graphics Solutions. Dan earned his Bachelor of Science in chemistry from the University of Delaware in 1981 and joined Hercules Inc that same year. He moved to MacDermid with the sale of the Electronics and Printing Division in 1995 and has since served in various technical and sales management roles. He and his family live near Atlanta, GA. To learn more about MacDermid Graphics Solutions, visit www.macdermid.com/graphics.*

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