PUBLIC RECORD

Are Coated Kraft Paperboard and Microflute "Like Goods"?

A Report

By

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The Question That I am Answering

My name is Charles P. Klass. I have been retained by Kingsman Legal acting on behalf of Graphic Packaging International LLC and Graphic Packaging International Australia Converting Ltd in relation to Investigation 548 by the Australian Anti-Dumping Commission to prepare a report to Kinsman Legal setting out an opinion on the following question within my field of expertise:

> ***Is microflute a "like good" to the goods under consideration?***
>
> *The goods under consideration are:*
>
> > *kraft paperboard, coated on one side with clay of other inorganic substances, grammage 360-430 grams per square metre (GSM), wet strength treated.*
>
> *Microflute is:*
>
> > *a narrow caliper corrugated cardboard comprised of three layers as follows:*
> >
> > - *Clay coated top sheet liner (normally printed)*
> > - *Corrugated medium*
> > - *Liner*

Appendix A is a detailed and complete description of the questions upon which I was requested to address and opine.

In performing these services and preparing this report, I agreed to:

- do so to a high professional standard
- act impartially and not conduct myself as an advocate for the case of the client; and
- be familiar with and, to the extent relevant to the matter, act in accordance with the Federal Court of Australia Expert Evidence Practice Note (GPN-EXPT)

Overall Conclusion

In my opinion, microflute and the goods under consideration are not like goods. Indeed, for the reasons started in this report, they are very different products.

The very different physical and other characteristics come from the very substantial production differences. Kraft paperboard is made on a paper machine. Microflute is not a product made on a paper machine. Microflute is a converted product made by combining three layers of paperboard on a corrugator.

Qualifications

My *curriculum vitae* is attached as Appendix B. I have six decades of paper industry experience including manufacturing paperboard, consulting with producers of coated

unbleached board and microflute corrugated and teaching courses in containerboard manufacture, corrugating and printing and imaging of paper packaging materials for TAPPI (Technical Association of the Pulp and Paper Industry), as Adjunct Professor of Chemical and Paper Engineering on the faculty of Western Michigan University and as a guest lecturer at other universities. I have done and coordinated research in the areas of coated solid unbleached paperboard, containerboard manufacture and corrugating including microflute corrugating.

After graduating from Western Michigan University in1962, I began working as a process engineer in a mill making linerboard, corrugating medium and corrugated containers including flexographic printing. I subsequently worked in a mill making printing papers and became intimately familiar with offset lithography. Other relevant experience includes supplying chemicals for papermaking and coating and as a supplier of paper and paperboard coating machinery.

In 1986, I became a consultant to paper and allied industry companies all over the world and have continued doing so until the present. This included experience in consulting on coated kraft paperboard and development and application of microflute corrugated.

I have been a member of TAPPI, the Technical Association of the Pulp & Paper Industry since 1958 and have been active in association leadership, teaching courses and making technical presentations. I have served as Chair of the TAPPI Paper Manufacturing Division and the Coating Process Committee. I was honored as a TAPPI Fellow in 1984 and received the TAPPI Distinguished Service Award in 1994. In 2015, I received TAPPI's highest honor, the Gunnar Nicholson Gold Medal for individual achievement in paper and packaging industry innovations that have been commercialized on a global basis.

I was elected to the Paper Industry International Hall of Fame in 2016.

I was appointed to the Western Michigan University faculty as Adjunct Professor of Paper Engineering, Chemical Engineering & Imaging in 1999 and continued in this role up to the present. I teach courses at Western Michigan University in Advanced Papermaking, Containerboard Manufacture, Corrugating, Paper and Paperboard Coating. I have been elected to the Western Michigan University Academy of Engineering Excellence.

I have served as guest lecturer at various universities and also taught courses on papermaking, coating and corrugating in Brazil, China, Thailand and Israel.

I have numerous publications on papermaking, paper chemistry, paper and paperboard coating and paperboard packaging including both trade magazine articles and peer-reviewed journals. I have written chapters in the textbooks used for papermaking courses. I was chosen to update and rewrite several chapters in the fourth edition of *The Handbook for Pulp and Paper Technologists.*

The Goods Under Consideration and Microflute

The goods under consideration are:

> *Kraft paperboard, coated on one side with clay of other inorganic substances, grammage 360-430 grams per square metre (GSM), wet strength treated.*

Microflute is:

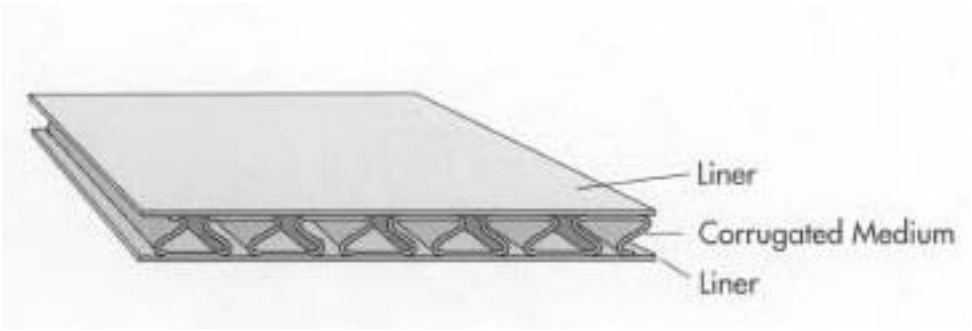
a narrow caliper corrugated cardboard comprised of three layers as follows:

- *Clay coated top sheet liner (normally printed)*
- *Corrugated medium*
- *Liner*

Counsel has provided samples of both the Graphic Packaging coated kraft wet strength paperboard and the Visy Microflute marketed for use as beverage carrier for inspection and analyses on which to base my professional opinions.

The grade of kraft paperboard under consideration is Solid Natural Kraft Coated Folding Carton Board, a high wet-strength sheet used primarily for beverage packaging applications manufactured by Graphic Packaging International in the southern United States at mills located in Macon, Georgia and West Monroe, Louisiana. The fiber raw material at both mills is southern pine. The board is formed as a solid sheet and subsequently surface sized, pigment coated and calendered to provide a smooth and ink receptive printing surface. The pigment coating provides a uniform white appearance over the natural brown color of unbleached kraft pulp fibers.

Microflute is a corrugated board construction comprised of three layers laminated together.



In the case of the VISY microflute product, each of the three components is made separately. The top linerboard layer is clay coated to cover the brown kraft and/or recycled fibers. In cases requiring high definition graphics the board is preprinted prior to conversion on the corrugator. The middle layer is corrugated medium made from recycled fibers. The bottom layer is kraft or recycled linerboard.

Each of the three components is made at a paper mill and shipped to the corrugator in roll form. When the top layer is to be printed, it is unrolled, preprinted, and rolled up. The preprinted roll is used in the double-backer on the corrugator to form the printed outside of the package.

Microflute is Not a Like Good

A "like good" need not be alike in all respects to the goods under consideration but must have characteristics closely resembling those of the goods under consideration. Likeness may be assessed by reference to the following considerations:

- *Physical likeness*
- *Commercial likeness*
- *Functional likeness*
- *Production likeness*

For the reasons that follow, my opinion is that microflute is not a like good by reference to these considerations.

Physical Likeness

When considered from the viewpoint of physical likeness, microflute and coated wet strength kraft paperboard are not like goods. The significant physical differences stem from the very different ways they are produced.

- *Whether physical characteristics are similar and the extent of differences. Characteristics to consider include: Size, Shape, Content, Weight, Appearance, Taste, Grade, Standards, Age, Strength, Purity, Chemical composition*

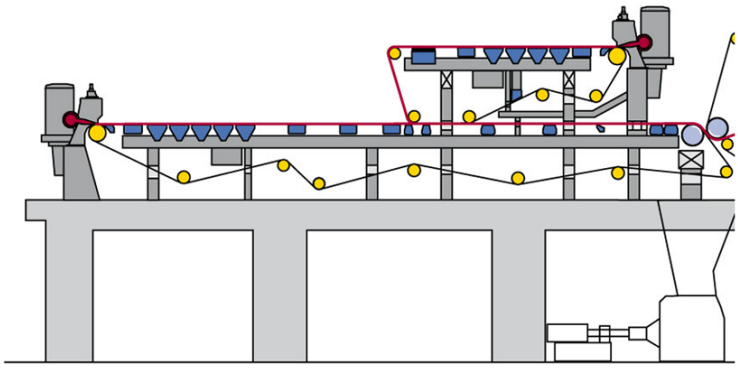
Microflute and coated natural kraft paperboard are not like goods. Microflute was developed as a lightweight box material of construction that is well suited to a wide variety of packaging and display applications. Examples of microflute applications include:

- Advertising and promotional displays
- Clamshells for fast food restaurants
- Boxes and gift packs for premium liquor
- Cosmetics packaging
- Packaging for electronics and digital devices
- Alternative to multi-ply recycled boxboard for folding cartons

Microflute continues to grow in all regions of the world. The advertising bulletin for *Micro Flute Paper Market*, a multi-client study just published by Future Markets Insights forecasts: “Micro Flute Paper Market Expected to Witness a CAGR (Compound Annual Growth Rate) of 4.0% through 2019-2029.

Both kraft paperboard and microflute corrugated may be used for various applications and printed to appear somewhat alike, but there are dramatic differences in the two materials.

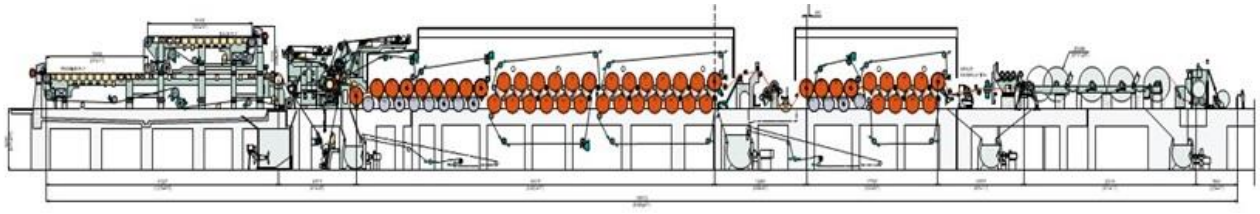
Kraft paperboard is a solid fiber material made from southern pine species (slash pine, loblolly pine and longleaf pine) that have been pulped by the kraft (sulphate) process, mechanically refined and formed into a solid sheet on a multiple fourdrinier machine.[1]



[1] The term “fourdrinier” refers to a paper machine configuration consisting of a moving endless plastic screen belt that receives a dilute slurry of fibers and water and drains the excess water off to form a sheet. It is named after Henry and Sealy Fourdrinier who financed its invention and patented it.

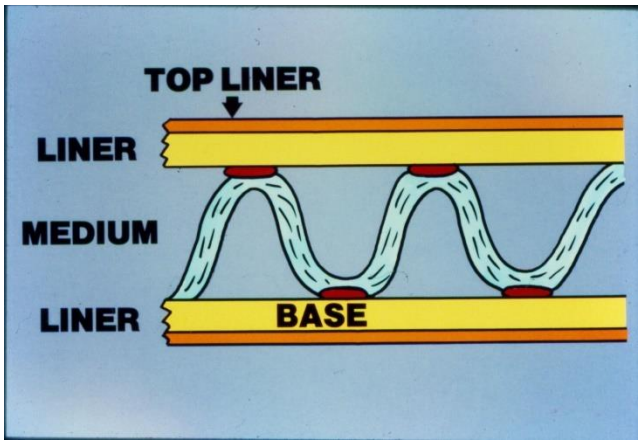
Forming section of a solid unbleached kraft board machine.

Basis weight of the solid kraft paperboard sheet at issue is 360 – 430 grams per square meter. Wet strength resin is added to the pulp slurry before sheet forming. The formed sheet is pressed and dried over steam heated cylinders. After initial drying to <10% moisture content, the web is surface sized by application of a starch solution to the surfaces. The surface sized sheet is dried to <10% moisture and then coated with white pigment analogous to latex painting the sheet surface. The coating is dried, and the web is then calendered to provide a smooth and uniform surface for printing. The paperboard is reeled up and then slit and rewound for export in containers.

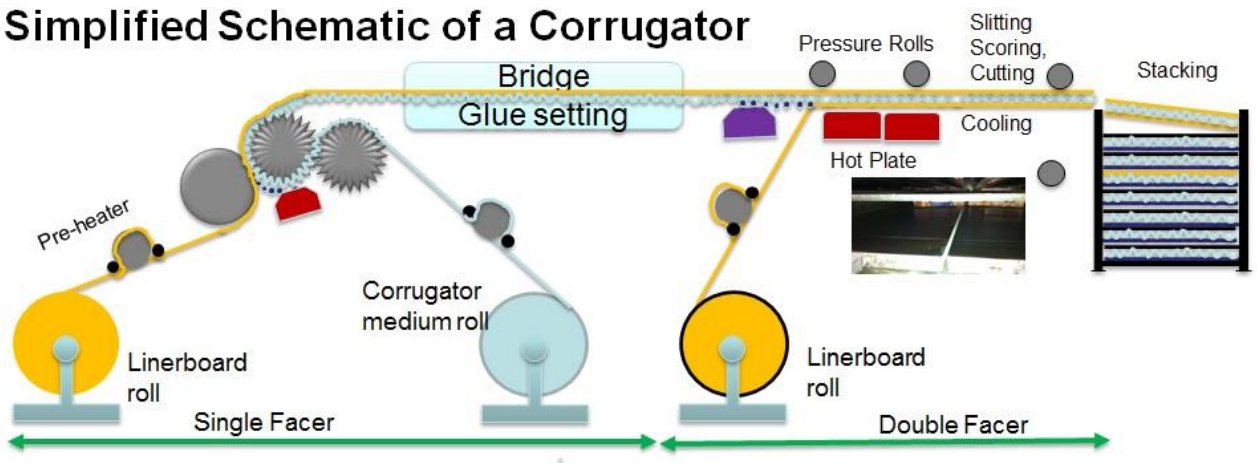


Overall view of a paper machine making solid kraft paperboard.

Microflute is totally different product. It is comprised of three layers of lightweight paperboard that are converted in a corrugator using completely different machinery and process flow.



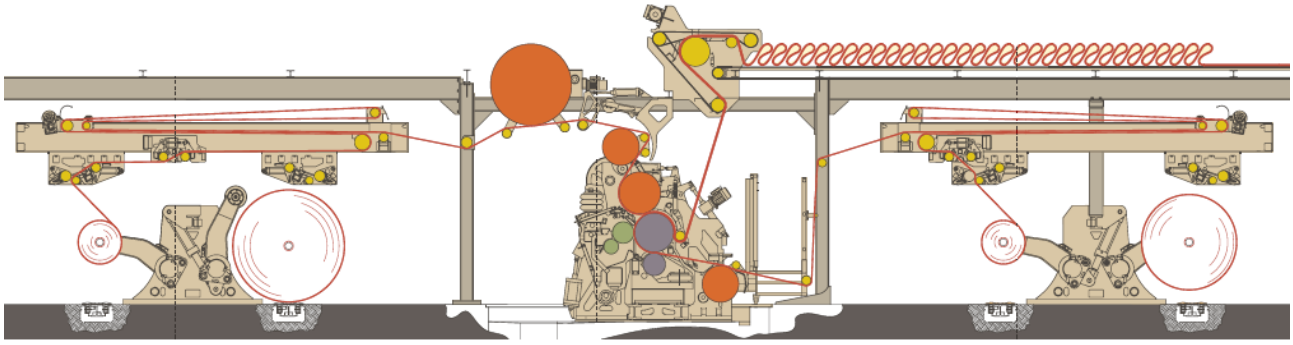
Here is a schematic view of the corrugating process:



Here is an overall view of a corrugator:

The first unit operation in corrugating is called single facing, where a roll of linerboard and a roll of corrugating medium are unwound, fed into corrugating rolls, and the tips of the corrugations glued onto the linerboard:

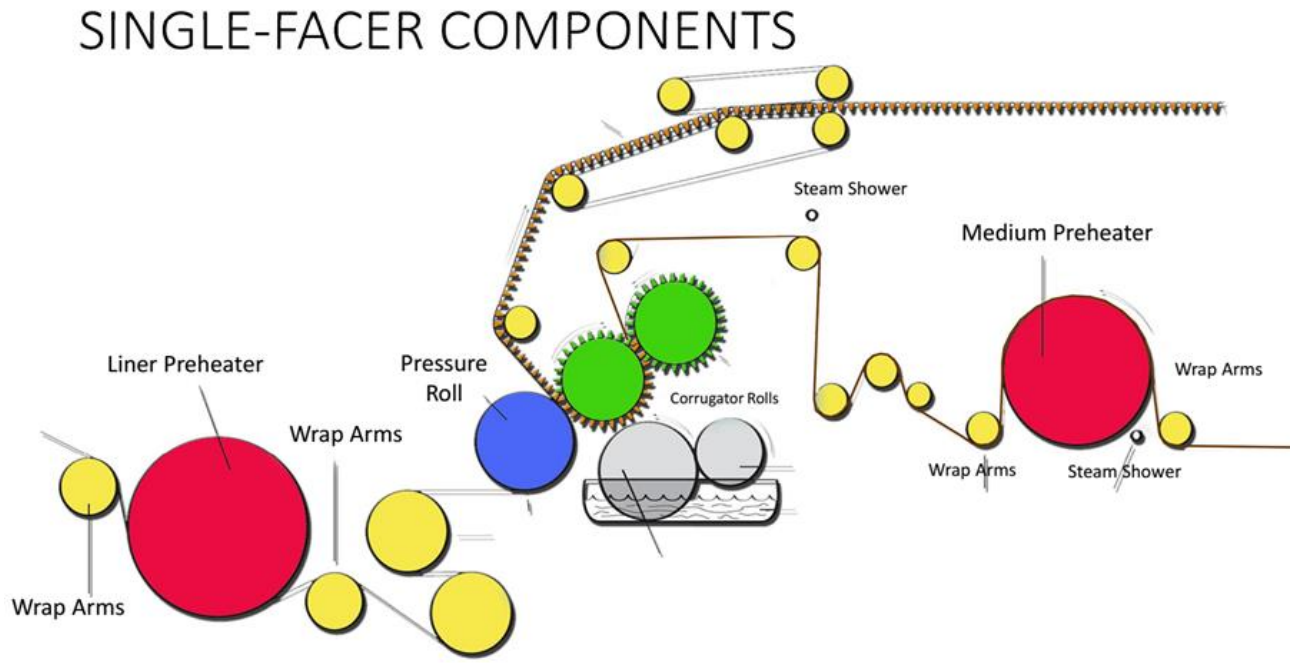
Accumulated Single Faced Board



Linerboard Unwind & Splicer Single Facer Unit Medium Unwind & Splicer

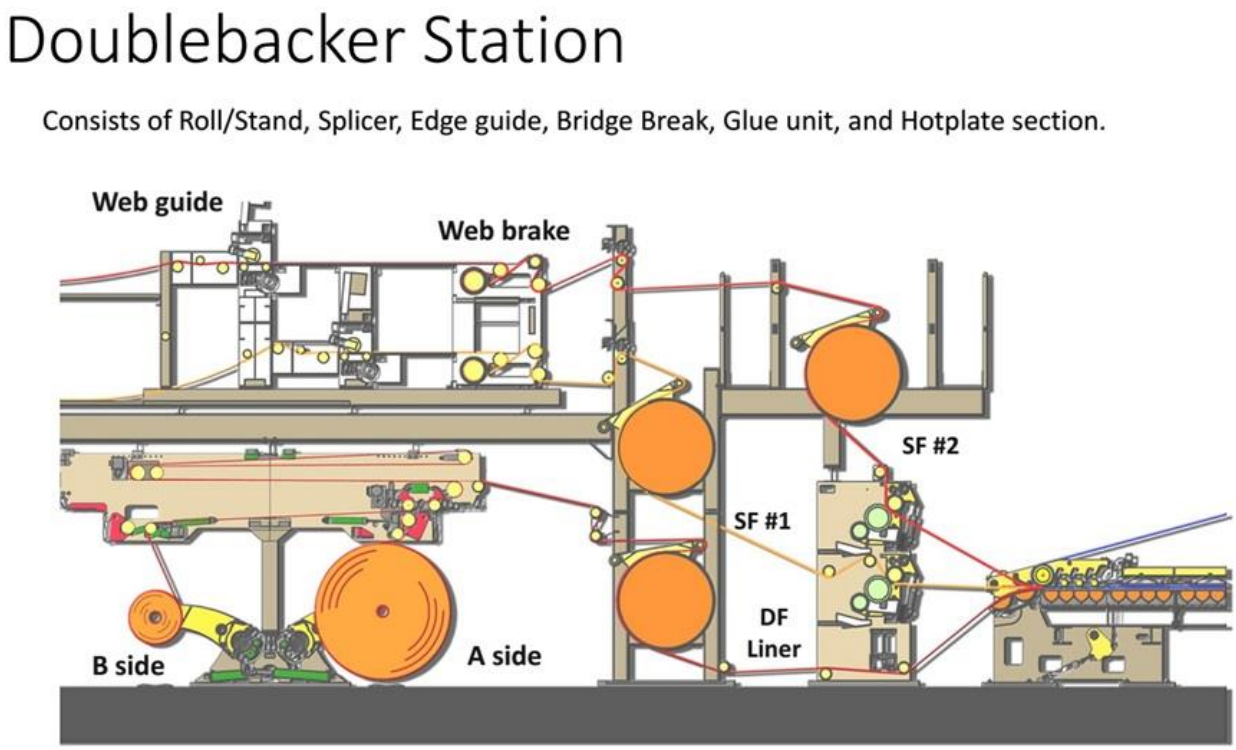
Overview of Corrugator Single Facer

This view of the single facer components illustrates what is happening to the linerboard and the medium in the single facer.



The single faced corrugated board goes to a double facer – also referred to as a double backer – where the second linerboard is unwound and glued onto the corrugation tips of the single face board. In the case of the microflute products under consideration, the

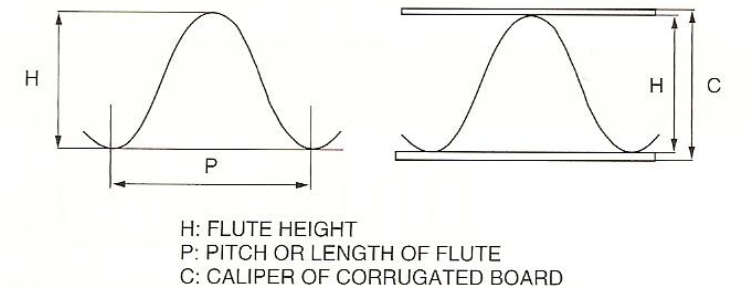
linerboard being fed to the double backer has been preprinted. Here is a view of the double backer:



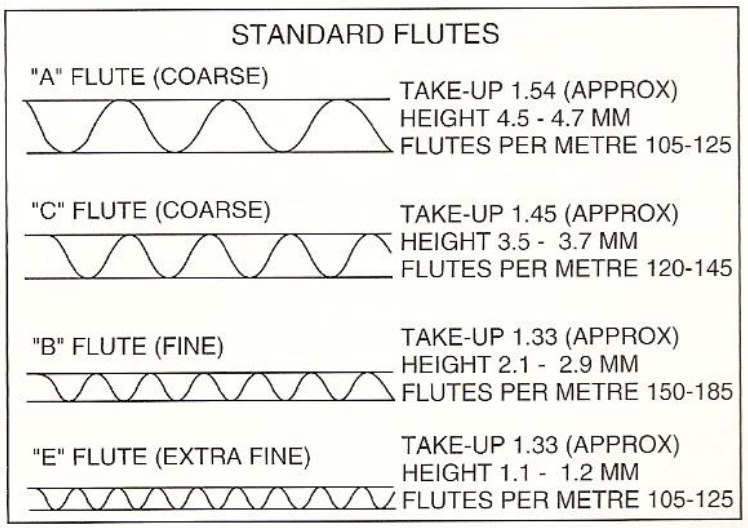
The double backed board then passes over a series of heaters called hot plates to dry out the water from the adhesives used to bond the liners to the fluted tips of the medium. At this point the combined microflute is rigid and can no longer be rolled up. It is transported flat on a corrugator belt, cooled, in-line slit and sheeted and stacked for shipment to the converter or end user. It may be die cut and converted into box blanks in line at the end of the corrugator, or this converting to package form may be done from sheets at another location.

Why is It Called “Microflute”?

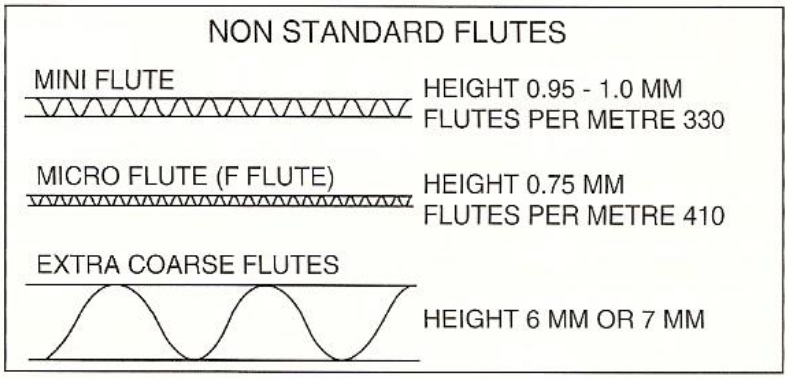
Corrugated is made in varying weights and thicknesses depending on the end use requirements of the boxes or displays being manufactured.



Standard flutes include A, C, B and E flutes:



Microflute is used for lighter weight and lower caliper constructions:



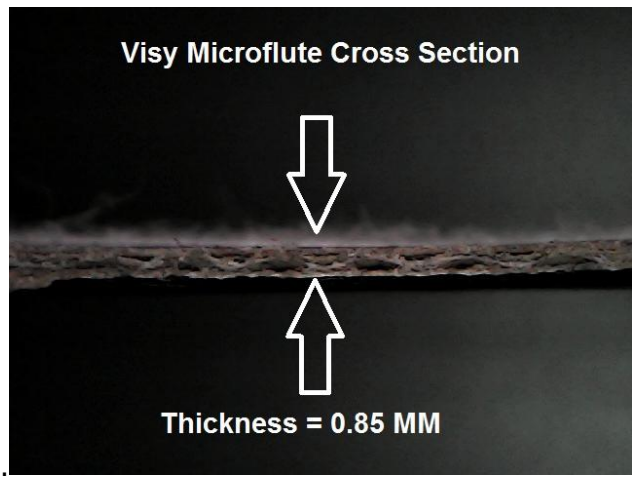
The use of microflute corrugated packaging has grown dramatically over the past three decades all over the world. Microflute was developed as a lightweight box material of construction that is well suited to a wide variety of packaging applications.

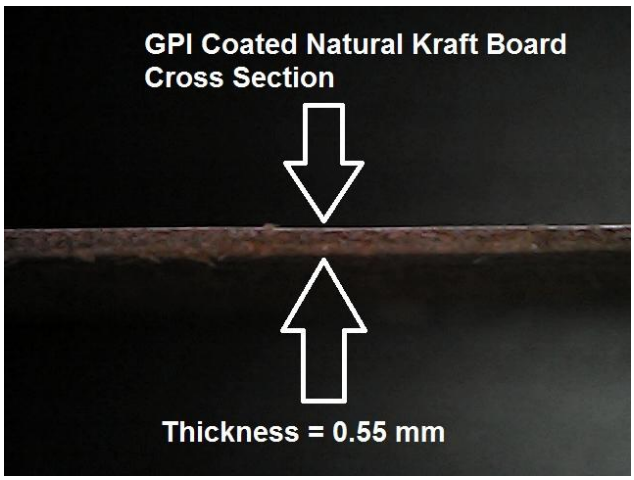
It continues to grow in all regions of the world. The advertising bulletin for *Micro Flute Paper Market*, a multi-client study just published by Future Markets Insights forecasts: “Micro Flute Paper Market Expected to Witness a compound annual growth rate of 4.0% through 2019-2029.

Thickness Differences between Microflute and Kraft Paperboard

Thickness differences further illustrate that microflute and kraft paperboard are not like goods.

Visy Microflute thickness is 0.85 mm compared to 0.50 – 0.58 mm for 360 – 430 gsm kraft paperboard. Microflute is 46 – 70% thicker than GPI kraft paperboard. Kraft paperboard has a machine direction to cross machine direction stiffness ratio of approximately 2.2:1.0. and is readily formed into packaging. Here are cross sections of the two products showing the microflute versus solid kraft paperboard construction.





The stiffness of microflute comes primarily from the corrugated structure, and it is highly directional along the axes of the flutes. It does not form as readily into beverage carrier packaging – often resulting in ragged edged or unsightly cracking at the folds.

Appearance and Printability Differences

When viewed from the standpoint of appearance and printability, microflute and kraft paperboard are not like goods.

Coated kraft paperboard is generally shipped as rolls of coated board ready for printing and converting. This provides the printer/converter with flexibility to use the same board for various customers or jobs and changes between jobs can be rapidly achieved.

The solid kraft paperboard is pigment coated with white pigments including kaolin clay and titanium dioxide to provide a uniform bright white appearance with optimized printing ink acceptance. The coated kraft paperboard product can be printed by high definition offset lithography with halftones up to 200 lines per inch. It can also be printed by flexography.

When microflute is for use in high graphic quality applications, it is commonly preprinted prior to corrugation using the flexography process. Flexographic preprint normally has resolution 85-100 lines per inch compared to the much finer resolution capability in offset printing coated kraft paperboard.

Preprint is a separate converting process that must be done before corrugating, which increases the complexity of the carton manufacturing process. In many cases, preprint must be ordered weeks ahead of the scheduled corrugating date.

GPI kraft paperboard has a uniform smooth surface. The surface of Visy microflute has a distinctive parallel “washboard” appearance as an artifact of the corrugating process that degrades the printed surface appearance.

Side-by-side close up photos of printed surfaces of the two products shows the significant difference in print fidelity.

GPI Coated Solid Unbleached Kraft VISY Microflute

Beverage Carrier Performance

The two products under consideration are not like goods when compared in terms of suitability and utility in beverage carrier applications.

GPI coated solid unbleached kraft carrier board is specifically designed for use in beverage carrier applications. Maintaining strength and appearance under wet conditions are important in beverage carrier applications.

When beverage carriers or boxes are chilled in refrigerators and subsequently exposed to higher temperature and humidity, condensation forms. If the carrier or box does not maintain strength due to wetting by condensation, it can lead to torn cartons, broken bottles and personal injuries.

It is common practice for consumers to place beverage carrier and cartons in ice or to add ice to chill the beverages – making it essential that the packaging retain strength when wet.

GPI coated unbleached kraft paperboard includes the use of wet strength resins in the paperboard to assure that the package maintains it strength and shape when wetted. The coatings on the surface of the board utilized crosslinked binders to prevent softening or flake-off of coating under wet conditions.

Microflute does not provide desired performance when wetted or under cyclical humidity conditions. Both the liners and the medium can absorb moisture – reducing their strength. Wetting can adversely affect the adhesive bond between the medium and the liners resulting in loss of box integrity.

Visy microflute includes the recyclable certification symbol on the package label – evidence of the absence of wet strength treatment:

GPI coated natural kraft board is wet strength treated, which may increase the difficulty of repulping in recycled paper mills, and the GPI product label does not include the recyclability claim or symbol.

This constitutes further evidence that microflute and coated natural kraft beverage carrier board are not like goods.

The design of the Visy microflute box for 30-375 ml cans of Pepsi MAX® needs a reinforcing strip glued onto the inside of the box over the manufacturer's joint to prevent handle failure:

This type of reinforcing strip is not normally required for coated kraft paperboard in the equivalent carton design – further evidence that the two are not like goods. Coated kraft paperboard provides superior strength that eliminates the need for a reinforcing strip laminated under the handle cutout, thus eliminating an extra step in carton converting.

Comparison of Composition of Solid Kraft Paperboard and Microflute

The two products under consideration are not like goods when compared in terms of materials composition. There are significant differences in the fibrous raw materials used in GPI solid unbleached kraft paperboard and Visy microflute, and they are not like goods in that respect.

Coated solid unbleached kraft board such as that made in USA by GPI is made from kraft pulp made from southern pine species – Slash Pine, Loblolly Pine and Longleaf Pine – that grow exclusively in the southeastern United States. The superior strength properties of these fibers are the reason that most of the kraft paperboard is manufactured in the region. For use in paperboard applications the thick cell walls of the southern USA pines make them superior to the Radiata Pine used for kraft pulping in Australia.

Species	Fiber Length. mm	Fiber Diameter, µm	Cell Wall Thickness, µm
Southern Pine[2]	4.6	35-45	6-10
Radiata Pine[3]	3.0	30.4-31.8	2.2-3.1

It is not known whether the linerboards used in microflute are unbleached kraft pulp or recycled linerboard.

Coated wet strength kraft paperboard is exported from the USA for beverage carrier applications in all regions of the world.

Commercial Likeness

Microflute and coated kraft paperboard are not like goods from the perspective of commercial likeness.

> *Commercial likeness refers to attributes identifiable from market behaviour.*
>
> - *Are the goods directly competitive in the market? e.g. do the goods compete in the same market sector? Within a market sector, are the goods similarly positioned?*
> - *To what extent are participants in the supply chain willing to switch between sources of the goods and like goods? e.g. willingness of participants to switch between sources may suggest commercial interchangeability.*
> - *How does price competition influence consumption? e.g. close price competition may indicate product differentiation is not recognised by the market.*
> - *Are the distribution channels the same?*
> - *How similar is the packaging used? Does different packaging reveal significant differences in the goods, or highlight different market sectors?*

Visy microflute and GPI coated solids unbleached kraft carrier board are competing for some of the same business with beverage packagers. However, this does not prove that they are like goods. Microflute is sold for a wide variety of applications other than beverage carriers including packaging food and non-food items. The wet strength kraft paperboard is engineered and manufactured for consistent performance in beverage carrier applications including exposure to varying environmental conditions forming condensate that will reduce the strength of a non-wet strength board and exposure to ice and water.

Microflute and coated kraft paperboard are not readily substitutable as like goods. Coated kraft paperboard is imported unprinted and can be readily used for a variety of beverage packaging designs with rapid changeover. On the other hand, if microflute is preprinted

[2] G.A. Smook, *Handbook for Pulp and Paper Technologists,* 4th Edition, TAPPI PRESS 2016, Table 2-4, p. 19
[3] S Kato *et. al. Plant Molecular Biology* (2006) 60:565-58

and only usable for one specific packaging application, it cannot be used for a different package design without ordering a different preprint in advance.

I do not have data on the pricing of the two products and cannot opine on price competition and how it might impact consumption. Similarly, I am not knowledgeable on distribution channels in Australia. However, in USA the physical differences described above result in different pricing and channels of distribution.

There are differences in packaging of the two products. Microflute is often preprinted and supplied as microflute corrugated to be converted by die cutting. If it is done in line on the corrugator, microflute exists only for a short time in the corrugating line. Coated kraft paperboard is imported as rolls that are subsequently sheeted and printed by offset lithography for converting into beverage carriers. From this standpoint, they are not like goods.

Functional Likeness

Microflute and coated wet strength natural kraft beverage carrier board are not like goods from a functional likeness standpoint.

> *Functional likeness refers to end-use. End-use will not of itself establish like goods, but may provide support to the assessment of physical and commercial likeness.*
>
> - *Do the goods have the same end use? To what extent are the two products functionally substitutable? e.g. both a shovel and an earthmoving machine can move earth.*
> - *To what extent are the goods capable of performing the same or similar functions? e.g. an earthmoving machine is capable of moving earth more rapidly than a shovel.*
> - *Do the goods have differential quality? Quality claims can be subjective. Objective evidence has higher probative value e.g. by standards, or the extent consumers are willing to use the goods to perform the required functions.*
> - *Is consumer preference likely to change in the future? Consider consumer behaviour in other markets/ countries.*

In the beverage carrier application end use, the two products are functionally substitutable. They can both be used to make beverage carriers. However, there are significant differences.

As discussed above, wet strength is an important characteristic for beverage carrier applications. GPI coated unbleached beverage carrier board and the coating on it are resistant to loss of strength, appearance and functionality when exposed to water and/or varying environmental conditions. Visy microflute does not provide this important characteristic.

The differences in wet strength, thickness, surface smoothness, washboarding and printing fidelity show that the two products are not like goods.

The flexibility of being able to print and use GPI board for a variety of package configurations and printing compared to the need to order microflute corrugated preprinting in advance is evidence that the two products are not like goods.

Production Likeness

Coated wet strength kraft paperboard and microflute are made from different materials using different production processes and are not like goods from the production likeness viewpoint.

> *Different production processes may produce identical goods. However, different production processes may be used to create different product characteristics. A comparison of production process will not of itself establish like goods but may highlight differences or provide support to the assessment of other considerations.*
>
> - *To what extent are the goods constructed of the same or similar materials?*
> - *Have the goods undergone a similar manufacturing process? If different, what is the impact of those differences?*
> - *Are the costs of manufacture similar? A similarity in the cost of manufacture may be an indicator of likeness but is not determinative.*
> - *Are there any patented processes or inputs involved?*

GPI coated unbleached kraft board and Visy microflute are made from significantly different materials using dramatically different manufacturing processes. The differences start with the basic raw materials:

- GPI board is made from southern pine species with thick cell walls pulped by the kraft process. The pulp is refined and blended with wet strength resins. The product is made as a solid fiber board produced on a fourdrinier paper machine. It is surface sized with starch, coated with pigment coatings and calendered to provide smoothness. The coating formulation is designed to provide optimum ink acceptance, printability, and appearance. The product is shipped in roll form to Australia.
- Visy microflute is manufactured in a dramatically different process. It is made by gluing three separate layers of paperboard to form a microflute corrugated structure. The liners may be either kraft or recycled pulp. If they are Australian kraft pulp, the pulp is made from Radiata Pine, which has different properties than the USA southern pines used by GPI. The corrugating medium used in microflute is made from recycled fibres. The top liner is roll-to-roll flexo preprinted before corrugating. The microflute product is shipped as sheets and/or box blanks.

Key physical differences caused by the different manufacturing processes include:

- Maintenance of strength and appearance under wet conditions
- Better print fidelity by offset printing the GPI product

In conclusion, it is my professional opinion the microflute and coated kraft paperboard are not like goods.

Respectfully submitted,

Charles P. Klass

APPENDIX A

The Question Upon Which I Have Been Asked to Opine

Is microflute a "like good" to the goods under consideration?

The goods under consideration are:

> *kraft paperboard, coated on one side with clay of other inorganic substances, grammage 360-430 grams per square metre (GSM), wet strength treated.*

Microflute is:

> *a narrow caliper corrugated cardboard comprised of three layers as follows:*
>
> - *Clay coated top sheet liner (normally printed)*
> - *Corrugated medium*
> - *Liner*

A "like good" need not be alike in all respects to the goods under consideration but must have characteristics closely resembling those of the goods under consideration. Likeness may be assessed by reference to the following considerations:

Physical likeness

- *Whether physical characteristics are similar and the extent of differences. Characteristics to consider include: Size, Shape, Content, Weight, Appearance, Taste, Grade, Standards, Age, Strength, Purity, Chemical composition*

Commercial likeness

Commercial likeness refers to attributes identifiable from market behaviour.

- *Are the goods directly competitive in the market? e.g. do the goods compete in the same market sector? Within a market sector, are the goods similarly positioned?*
- *To what extent are participants in the supply chain willing to switch between sources of the goods and like goods? e.g. willingness of participants to switch between sources may suggest commercial interchangeability.*
- *How does price competition influence consumption? e.g. close price competition may indicate product differentiation is not recognised by the market.*
- *Are the distribution channels the same?*
- *How similar is the packaging used? Does different packaging reveal significant differences in the goods, or highlight different market sectors?*

Functional likeness

Functional likeness refers to end-use. End-use will not of itself establish like goods, but may provide support to the assessment of physical and commercial likeness.

- *Do the goods have the same end use? To what extent are the two products functionally substitutable? e.g. both a shovel and an earthmoving machine can move earth.*
- *To what extent are the goods capable of performing the same or similar functions? e.g. an earthmoving machine is capable of moving earth more rapidly than a shovel.*
- *Do the goods have differential quality? Quality claims can be subjective. Objective evidence has higher probative value e.g. by standards, or the extent consumers are willing to use the goods to perform the required functions.*
- *Is consumer preference likely to change in the future? Consider consumer behaviour in other markets/ countries.*

<u>Production likeness</u>

Different production processes may produce identical goods. However, different production processes may be used to create different product characteristics. A comparison of production process will not of itself establish like goods but may highlight differences or provide support to the assessment of other considerations.

- *To what extent are the goods constructed of the same or similar materials?*
- *Have the goods undergone a similar manufacturing process? If different, what is the impact of those differences?*
- *Are the costs of manufacture similar? A similarity in the cost of manufacture may be an indicator of likeness but is not determinative.*
- *Are there any patented processes or inputs involved?*

APPENDIX B

CURRICULUM VITAE OF CHARLES P. KLASS

CHARLES P. KLASS
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MADEIRA BEACH, FL 33708-2628

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EDUCATION

Western Michigan University: BA in Mathematics with minors in Pulp & Paper Technology and Chemistry, 1962.

Pace University: MBA in Marketing Management, 1968 - Thesis: Impact of the Marketing Concept on Management of the Paper Industry; doctoral level course work in strategic planning, finance, organization development, and international business.

EXPERIENCE

1986-Present: Klass Associates Inc., Radnor, PA and Madeira Beach, FL - President - Consultant to the pulp and paper industry and affiliated companies: coating and papermaking technology, strategic planning, feasibility studies, value-added grade development, recycled fiber usage, deinking processes, due diligence on acquisitions and mergers, expert testimony and assistance in regulatory approvals.

1982-1986: BTG Coating Systems, Dallas, TX/Inventing of America Ltd., King of Prussia, PA - Vice President - Founded and developed North American sales/service subsidiary of Swedish paper coater manufacturer; turned around sales decline; managed acquisition of Dahlgren LAS business and consolidation into fully integrated manufacturer of coating equipment.

1978-1981: Asten Group Inc., Devon, PA - Corporate Marketing Director/Director of International Sales - Managed marketing function of supplier of paper machine clothing; coordinated acquisition of French felt manufacturer; developed worldwide sales/service organization.

1975-1977: Lockport Felt Division of Carborundum Co., Newfane, NY - General Sales Manager - Managed marketing function of supplier of paper machine clothing including wet press felts and dryer fabrics.

1969-1975: Merck Paper Chemicals, Rahway, NJ - Sales Representative/Product Manager/Marketing Manager - Progressed from field sales into marketing management for maker of wet end and coating specialty chemicals; achieved rapid growth in sales and net income; managed commercialization of two new product lines.

1964-1968: Paper Trade Journal, New York, NY - Associate Editor - Edited weekly paper industry trade and technical magazine.

1963-1964: Westvaco Corp., Luke, MD - Operating Engineer - Responsible for two paper machines with on-machine coaters.

1962-1963: Union Camp Corp., Savannah, GA - Process Engineer - Projects focused on kraft pulping and paper machine optimization.

1960-1961: Oxford Miami Paper Co., West Carrollton, OH – Laboratory technician - Projects focused on deinking plant and testing of mill effluents

1959-1960: Hamilton Paper Co., Plainwell, MI - Worked night shift as deinking/bleach plant chemist to finance education.

1957-1958: Department of Pulp and Paper Technology, Western Michigan University, Kalamazoo, MI – Laboratory and pilot plant technician

PROFESSIONAL AFFILIATIONS

Western Michigan University – Adjunct Professor of Chemical & Paper Engineering

TECHNICAL ASSOCIATION OF THE PULP & PAPER INDUSTRY (TAPPI): Lifetime Member - Served on Board of Directors; former chairman of Paper and Board Manufacture Division and Management Services Division; currently on Coating Process Committee, Papermakers Committee, Basestock Committee, and Publications Committee; chairman and chief instructor of Coating Process Short Course and Marketing Short Course; instructor for Coated Paperboard Course; co-chair and instructor Paper Machine Optimization and Containerboard Manufacture Courses.

PUBLICATIONS

Numerous publications in technical journals and trade magazines on pulp and paper manufacturing technology, marketing management, technology forecasting, business planning, and human resource development; co-author of paper technology textbooks; frequent speaker and panelist at paper industry technical and business conferences.

PATENTS

Seven issued patents on papermaking and coating chemicals plus two pending patents.

AWARDS AND HONORS

Paper Industry International Hall of Fame.

TAPPI Fellow.

TAPPI Paper and Board Manufacturing Division Award.

Harris O. Ware Prize for contributions to paper and paperboard manufacture.

TAPPI Distinguished Service Award.

TAPPI Coating and Graphic Arts Division Leadership and Service Award

TAPPI Gunnar Nicholson Gold Medal Award

Paper Technology Foundation Inc., Western Michigan University
- Fellow
- Hall of Fame Award

Western Michigan University Academy of Engineering Excellence