



# Filling the need for speed

Utilizing a starch-modified kaolin for improved drying at equivalent board strength allows producers to increase production rates by as much as 5%.

Currently, there are over nine million tonnes of virgin linerboard capacity in the Southern US and another million tonnes of recycled linerboard. This market segment has historically resisted the use of virgin filler based on the negative impact on strength properties. However, even a small penetration into this market can yield a significant volume of kaolin filler clay. If successful commercialization is achieved, this product can significantly impact Imerys Deepstep Road Plant profitability. Likewise, other global Imerys kaolin or ground calcium carbonate assets may benefit from the starch modification processing required to produce LinerMax. The following business case was based on North American production, but can be applicable to Asian and European board producers.

OCC (old corrugated containers) demand to China is strong and virgin fiber markets are expanding, leaving linerboard producers with lower profit margins and a limited ability to increase productivity. The use of cost competitive mineral filler could supplement the mill's raw material supply and help alleviate some of these market pressures. However, use of standard fillers in board and packaging grades has been limited due to the negative impact minerals may have on paperboard strength.

The use of LinerMAX, a new modified kaolin from Imerys, can allow linerboard producers to incorporate 3-5% mineral in their base plies while maintaining critical strength properties. Additional cost-saving benefits include:

- Virgin fiber extension
- Improved dewatering
- Higher press solids
- Reduced drying energy demands
- Increased production rate if your paper machine is drying or fiber limited

By far the most significant of these potential benefits is improved productivity based on available speed increases at higher drying rates.

## History of Standard Fillers in Paperboard

Kaolin based fillers do not hold water in the same way as fiber. By substituting filler for fiber, couch and press solids are increased which results in improved drying rates. Extensive pilot and full scale trials have indicated couch solids increases of 1-2% are possible with a filler loading rate (based on fiber) of 5-10%. In order to demonstrate the concept, a higher filler loading range than normal was conducted in a pilot paper machine trial as illustrated in **Figure 1, below left**.

However, standard fillers interfere with fiber to fiber bonding and can cause a loss in critical strength properties. Corrugated containers are stacked as the goods they

contain are stored in warehouses, thereby subjecting the boxes to high compressive loads. Ring crush and short span compressive strength tests are the primary tests used to indicate performance of the linerboard at the end use. **Figure 2 (below)** illustrates the loss of compressive strength as standard filler is added to the board.

## LinerMAX

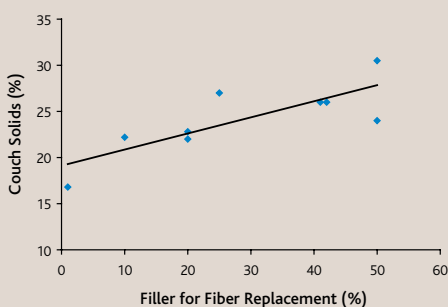
LinerMAX has been developed to replace fiber and allows paperboard producers to reduce energy/finished ton. This helps maximize productivity without loss in key strength parameters.

LinerMAX promotes fiber to filler bonding as illustrated in **Diagram 1, above right**:

- Standard kaolin filler and starch added independently results in poor and/or inconsistent fiber/filler bonding.
- Anionic trash present in the system competes with both clay and fiber for starch.
- Starch encapsulated kaolin results in a much better fiber/filler bond without significant strength loss.

LinerMAX is supplied as a slurry product. The product has an abrasion similar to fiber and is fit for use across the papermaking pH range.

**Figure 1: Fillers can improve drainage rates**



**Figure 2: Demonstrates the negative impact that standard fillers can have on strength.**

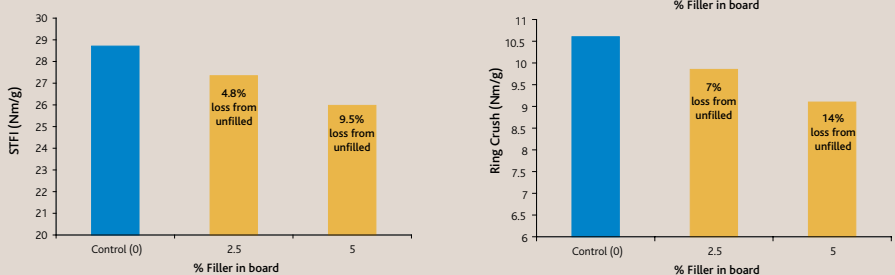
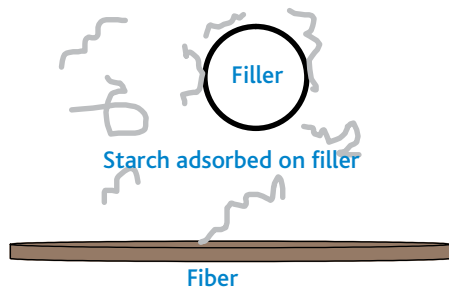
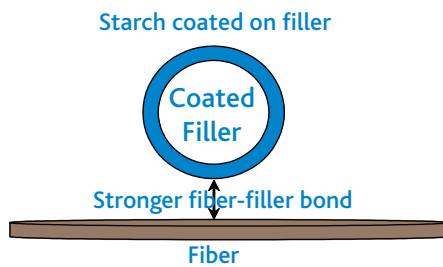


Diagram 1: Standard Filler Clay



LinerMAX



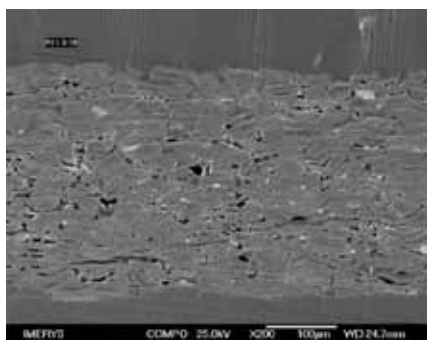
### LinerMAX Productivity Improvement

LinerMAX has been trialed primarily in Southern US virgin linerboard mills with trial durations spanning a few hours to thirty days.

A speed increase of approximately 100 fpm (30 m/min) was achieved over the year-to-date average speed in two 45lb (220 gsm) High Performance Liner grade runs during a 30 day commercial trial with LinerMAX. STFI strength was above target at 2-4% filler loading in the base ply, see **Figure 3 below**.

Similarly, LinerMAX showed impressive productivity gains across a range of grades during a multi-day trial. See **Figure 4 below**.

Below: Micrograph of Linerboard



### Quality Improvements with LinerMAX

In addition to increased productivity, LinerMAX can result in improved quality. Incorporation of LinerMAX in the linerboard base ply results in a more uniform substrate for the top ply. This trend was seen across the grade ranges in commercial runs longer than 24 hours. The table below illustrates an example from a 42 lb KLB (205 gsm) run in which the final product exhibits improved Emveco smoothness at lower calendering pressures. Additionally, the board is more uniform in the cross direction as indicated by the variation in basis weight and moisture. **See Table 1 below**.

Mills experiencing blistering at the corrugator or non-uniformity of print may benefit from using LinerMAX. One of the leading contributors to blistering and poor printability is density differences across the web.

### Application Recommendations

LinerMAX is a stable dispersed slurry that can be applied at multiple locations in the papermaking process. Long term use of LinerMAX will require proper storage, handling and retention of the product. Some points of consideration for the papermaker include:

- LinerMAX is low in abrasion
- LinerMAX can be added to thick or thin stock. Possible points of addition include:
  - suction side of the fan pump
  - suction side of the machine chest
  - primary cleaner accepts
- Like other pigments, LinerMAX must be stored in an agitated tank to prevent settling
- Typical loading rates of LinerMAX have been 3-5%, but may vary depending on grade and basis weight.



Figure 3: 45lb (220 gsm) High Performance Liner Commercial Trial.

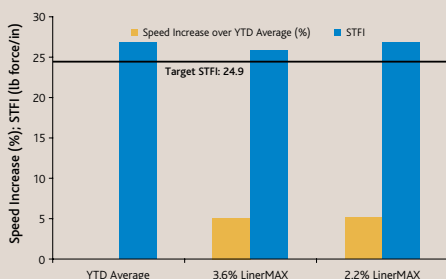


Figure 4. Productivity Gains with LinerMAX

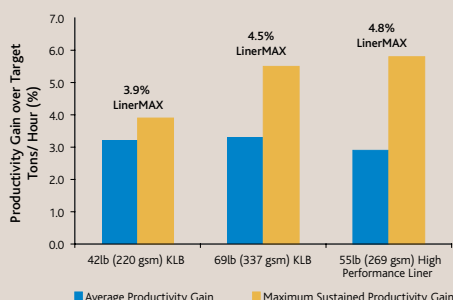


Table 1.

Parameter	Pre-Trial	LinerMAX Trial
Top Ply Freeness (CSF)	335	324
Caliper (mils)	11.1	10.9
Calender Load (pli)	227	225
Emveco Smoothness	143	121
Basis Weight CD Sigma	0.49	0.46
Moisture CD Sigma	0.93	0.74