–CONFIDENTIAL–

CROSSITOL®

The Breakthrough in Polyethylene Crosslinking Technology

Foams

Mar 2024

Sustainable. Economical. Innovative.

CROSSITOL® Cross-Linking Technology

- **Patented additive** and a family of master batches

XL 04470 LD **CROSSITOL®**	Photo-initiator (PI) for Polyethylene (PE) crosslinking

- **Off-line or on-line LED curing system** – tailor-made for each specific line.

PE FOAMS Cross-Linking

WHY CROSS–LINKING ?

1. Preventing the extruded slabs to melt and lose shape in the gassing and expansion stages of the foaming process
2. Controlling and improving the properties of the finished foam product

N3Cure CROSSLINKED SOLUTIONS

Make Plastic with Less Plastic

KAFRIT IL

CROSSITOL® Cross-Linking Technology

Designed as an alternative for E-Beam and peroxide technology

WHY CROSSITOL CROSS-LINKING?

- Lower expenses and waste
- Cross-linking degree easily controlled.
- Homogeneous cross-linking through the polymer bulk
- No post-process during oven cooling
- Process of cross-linking stops immediately after switching off UV equipment
- Cost savings on logistics in compare with curing at an external facility, addressing storage and transportation issues.

N3Cure CROSSLINKED SOLUTIONS

Make Plastic with Less Plastic

KAFRIT IL

PE foams CROSSITOL crosslinking - General recommendations

Additive concentration

- 10-20% CROSSITOL additive Depend on % gel needed.
- Promoter- depend on foaming process
- A more concentrated MB can be provided and the percentage in the matrix can be lowered

Curing process

- Curing with LED 365 lamps from both sides (homogeneous crosslinking)
- Curing with mercury in this thickness is not possible

Thickness

Up to 10 cm before foaming

Pigments

It should be possible with LED and organic pigments.
Need further testing

Case Study - A Big foams manufacturer in UK

Applications and Motivation

In the case of the client manufacturing, the production is carried out using High pressure nitrogen pressure technology.

1. PE films foams applications **- Replacing Peroxide technology** with UV curing technology –client's motivation is not entirely clear, probably because high expenses and energy waste, high-end materials and pollution and hazardous Process

2. Other polymers foams application – **Replacing E-beam technology** with UV curing technology, Mainly because of economic and logistical reasons (higher expanses of the process, complicated transports and time wasting) – CROSSITOL MB based on EMA . New project. Still under testing.

Case Study - A Big foams manufacturer in UK

Trial plan

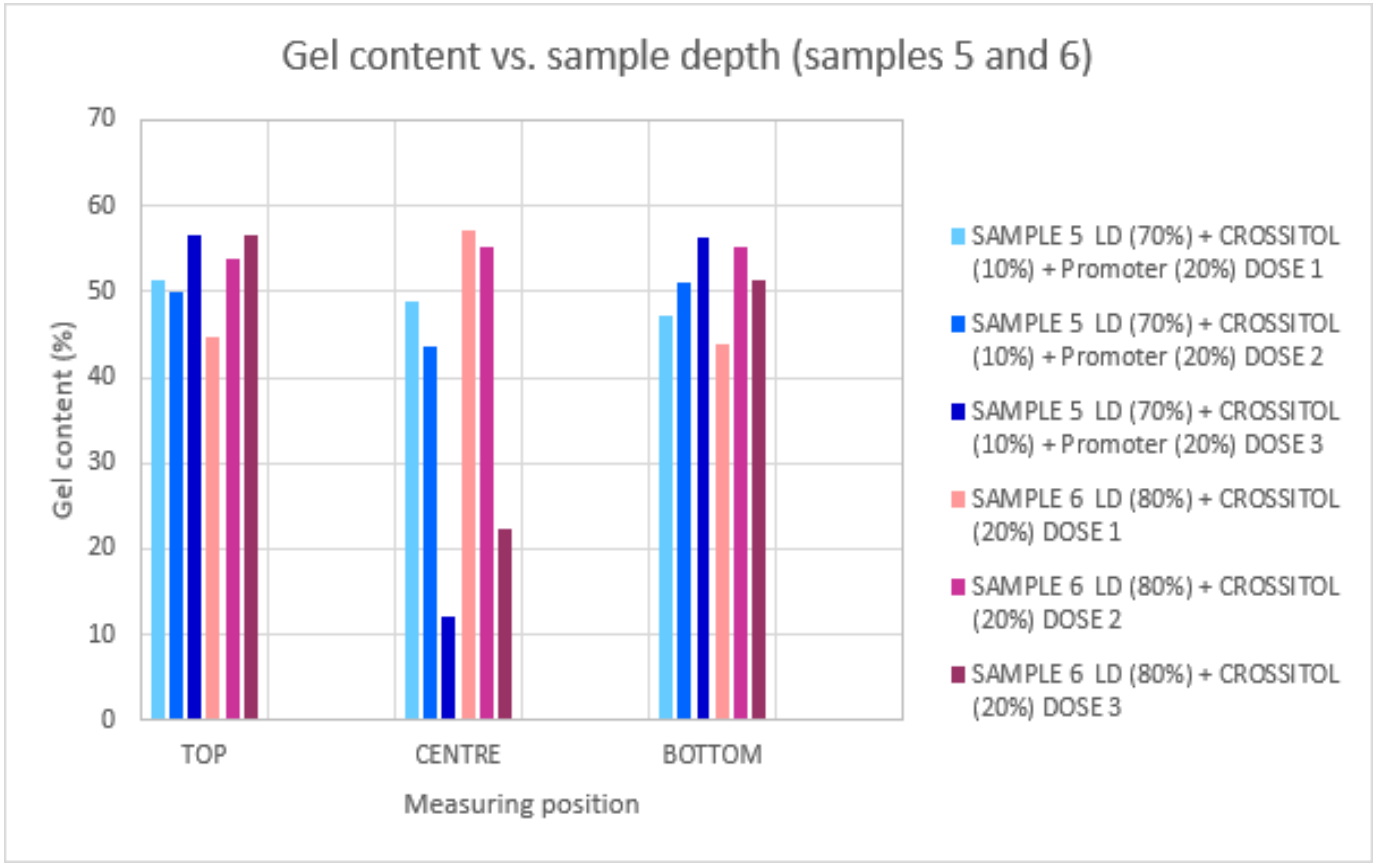
1. Production of extruded slabs
   a) Samples formulations in the table →
   b) Thickness slabs of 8-10 mm (before foaming)
2. Curing with LED and Mercury at N3Cure (before foaming)
3. Samples foaming
4. Tests:
   a) Gel content : target of 40-50% gel
   b) Company relevant physical tests

Sample No.	Sample desc.	Curing process
1	client ref	Crosslinked with peroxide
2	Negative ref Addition of carrier polymer – 10%	Crosslinked with peroxide
7	Negative ref Addition of carrier polymer – 30%	Crosslinked with peroxide
5.1	Crosslinker and promoter 1:2 10% - 20%	LED Curing – lower dose
5.2	Crosslinker and promoter 1:2 10% - 20%	LED Curing - higher dose
5.3	Crosslinker and promoter 1:2 10% - 20%	Mercury curing
6.1	Crosslinker only – 20%	LED Curing – lower dose
6.2	Crosslinker only – 20%	LED Curing - higher dose
6.3	Crosslinker only – 20%	Mercury curing

Case Study - A Big foams manufacturer in UK

Results - %Gel

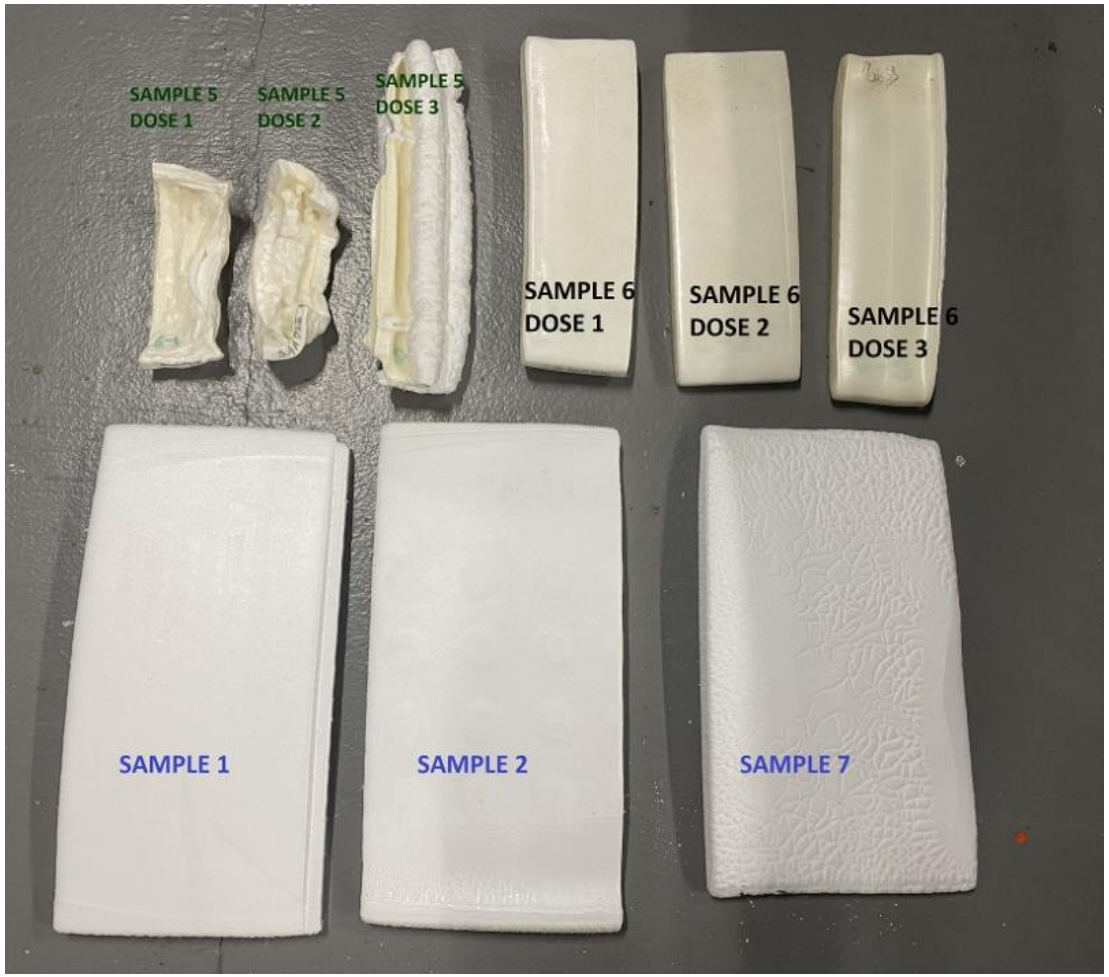
1. LED Samples had consistent crosslinking levels through the whole depths and reached gel content of up to 55%.
2. client reference are typically exhibit gel content around 40% (not tested).
3. Mercury samples exhibit inhomogeneous crosslinking at such high thickness



Case Study - A Big foams manufacturer in UK

Results – Foaming and Physical tests

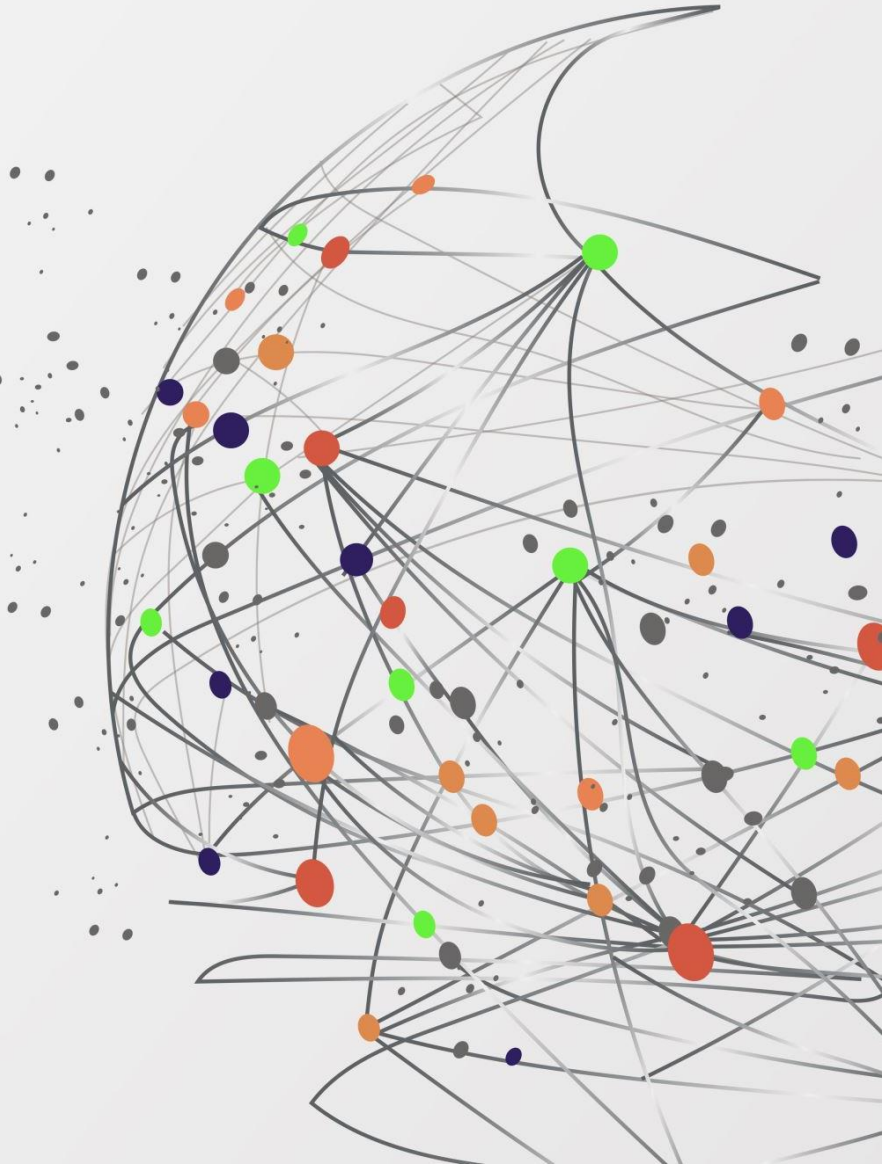
1. LED samples foam well.
2. mercury sample has some structure difference between outer and middle layers of the sample due to inhomogeneous crosslinking
3. Promoter samples did not foam well, likely due to the presence of the promoter and the additional network that interfered with the process.
4. **physical properties of LED samples were similar to those of the client standard product** (apart from a tensile test, which is not relevant for the customer)



Case Study - A Big foams manufacturer in UK

Curing system

- Due to the high thickness of the sample before foaming and the high gel content required, a large amount of energy is needed.
- Per the customer's request, the systems were planned to be offline system and operate at a slow speed of 0.5-1 meter/minute.
- The estimated cost based on these parameters is $450,000 to $550,000.



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