

CHEMISTRY THAT MATTERS™



# POLYCARBONAT NEU DEFINIERT: DIMENSIONSSTABILITÄT MIT ERHÖHTER CHEMIKALIENBESTÄNDIGKEIT

Lenorplastics Techday 24.09.2025

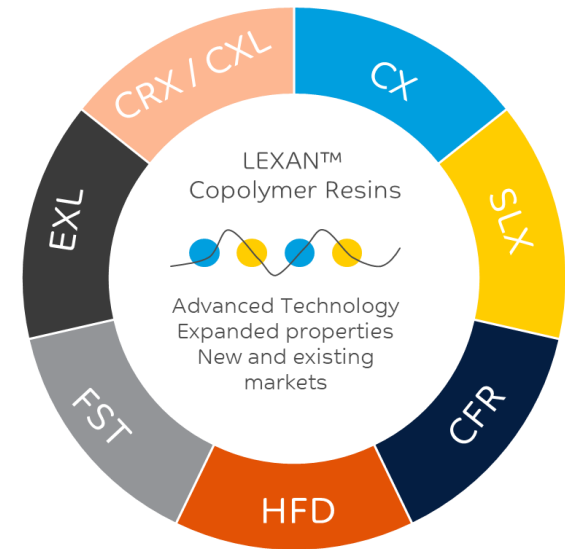
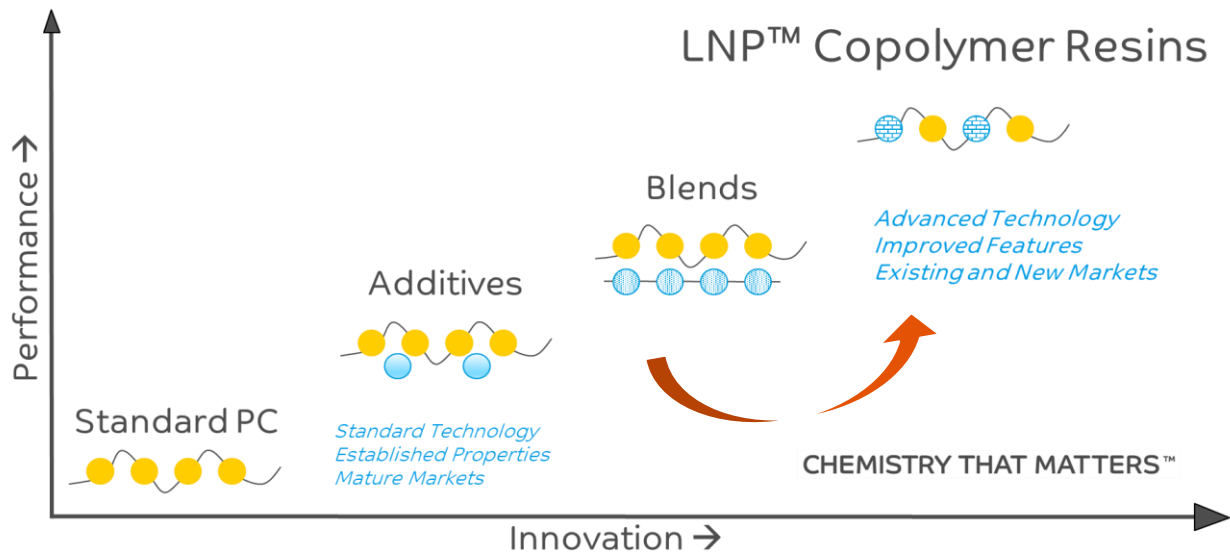
Julien Cathelin: Sr. Technical Development Engineer

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# THE CROSS-INDUSTRY TRENDS AND CHALLENGE

# SABIC SPECIALTIES: A PORTFOLIO OF EFFECTS TO MAKE CHEMISTRY MATTER

**X-INDUSTRY CHALLENGE**  
 Combine Sustainability with Durability

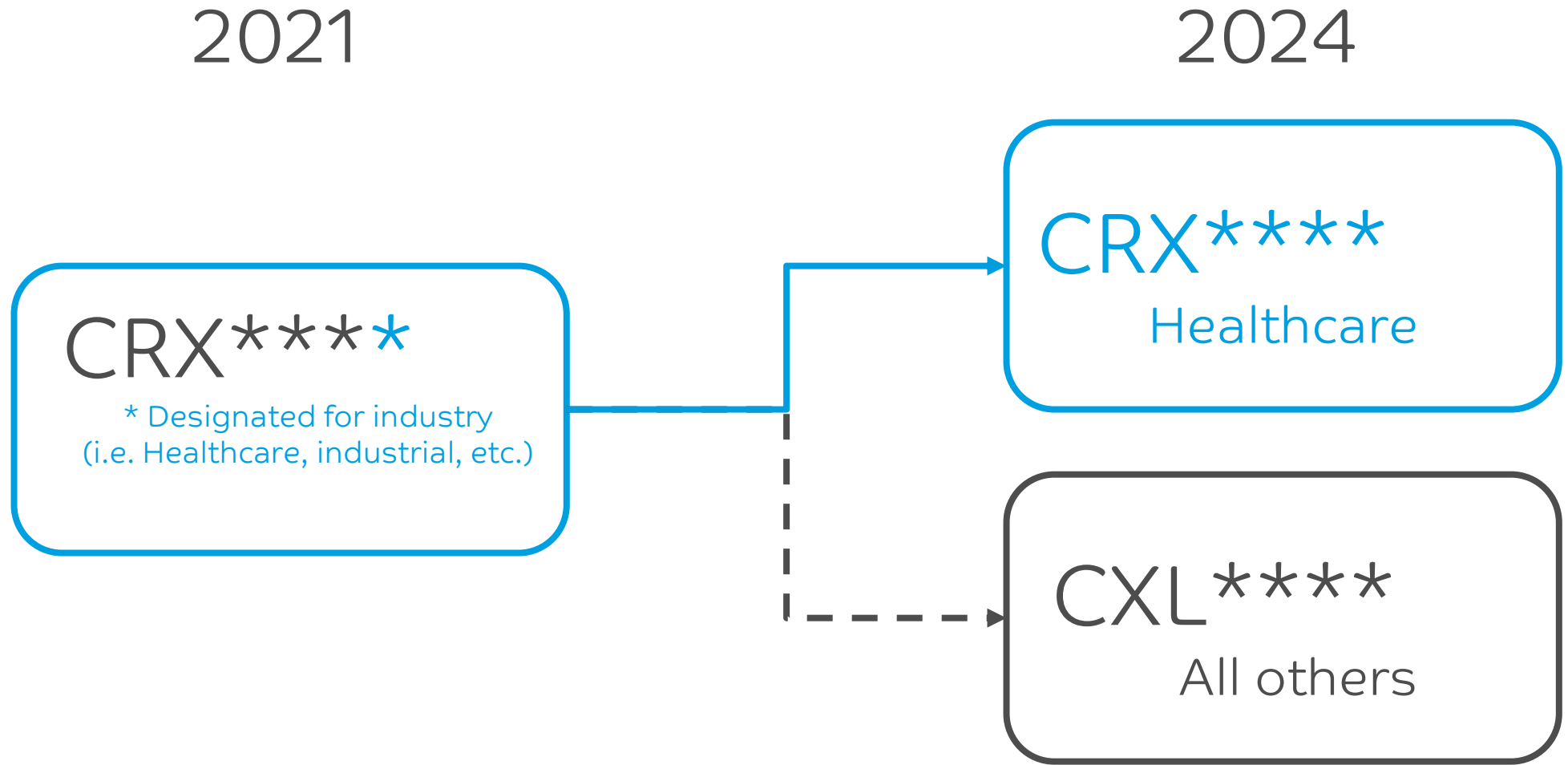


We focus our **Technology and Innovation** developments to **provide benefits across the value chain**

# KEY FEATURES OF THE DIFFERENT LNP™ COPOLYMER RESINS

LNP™ CRX & CXL resins	LNP SLX resins	LNP FST resins	LNP EXL resins
<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ Low temperature impact</li> <li>✓ Processability</li> <li>✓ Durability</li> <li>✓ <b>Chemical resistance</b></li> <li>✓ Colorability &amp; Aesthetics</li> </ul> <p>Potential Applications: Medical equipment housings &amp; components</p> 	<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ <b>Weatherability</b></li> <li>✓ High gloss</li> <li>✓ Retention of properties &amp; color after UV exposure</li> <li>✓ Scratch repairable</li> </ul> <p>Potential Applications: Lighting diffusers, OVAD fenders &amp; hoods, Meter windows, Automotive trims, Marine helms &amp; trims</p> 	<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ Weatherability performance</li> <li>✓ Chemical resistance</li> <li>✓ <b>Scratch resistance</b></li> <li>✓ Practical impact</li> </ul> <p>Potential Applications: Aircraft interiors, Rail, Ship – Window reveals, Trims Injection molding, extrusion, fibers</p> 	<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ <b>Low temperature impact</b></li> <li>✓ Processability</li> <li>✓ Impact retention after sec. ops.</li> <li>✓ Long term impact retention</li> </ul> <p>Potential Applications: Telecom, Handhelds, Mobile Phones, Motorcycle Helmets, Safety, Automotive, Outdoor electrical enclosures, Medical devices</p> 
LNP CFR/LUX resin	LNP HFD resins	LNP XHT resins	LNP CX resins
<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ <b>Thin wall FR</b></li> <li>✓ Clear V0 down to 1mm</li> <li>✓ Clear 5VA down to 3 mm</li> <li>✓ Excellent practical flow</li> <li>✓ Br-, Cl-, P- and Teflon-free FR</li> </ul> <p>Potential Applications: LED lighting, Outdoor lighting, Aerospace trims, PV converter display, fire alarms, electronics housing, medical housing</p> 	<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ <b>Improved flow/ductility</b></li> <li>✓ Well suited for thin wall applications</li> <li>✓ lower temp. processing</li> <li>✓ Lower birefringence</li> <li>✓ Transparent</li> </ul> <p>Potential Applications: Camera lenses, Medical housings, Safety eyewear, Consumer electronics</p> 	<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ <b>Improved heat resistance</b></li> <li>✓ Glass like transparency</li> <li>✓ Robust <b>Metallization</b></li> <li>✓ Improved <b>impact/flow vs HH PC</b></li> <li>✓ Colorability &amp; Aesthetics</li> </ul> <p>Potential Applications: Automotive bezel, fire safety helm, industrial lighting, autoclave application</p> 	<p>FEATURES:</p> <ul style="list-style-type: none"> <li>✓ Thin wall FR (0.75 ≤ V0 ≤ 1.5mm)</li> <li>✓ High level of processability, cycle time and release performance</li> <li>✓ Impact toughness</li> <li>✓ Colorability &amp; aesthetics</li> </ul> <p>Potential Applications: Battery pack, Thin-Wall Enclosures, Medical equipment enclosures, Industrial and business equipment</p> 

# TRODUCING NEW CHEMICAL RESISTANT COPOLYMER-CRX AND CXL



# THE MEDICAL DEVICES MARKET: DURABILITY TO WIPE AND DISINFECTION

# APPLICATIONS NEED CHEMICAL RESISTANCE IMPROVED SOLUTIONS

CRX\*\*\*\*  
Healthcare



INSULIN PUMP HOUSING



DENTAL CHAIR COMPONENTS



INFUSION PUMP HOUSING



HOSPITAL BED COMPONENTS



SURGICAL TOOLS



IMAGING DEVICES



ICU MONITORS

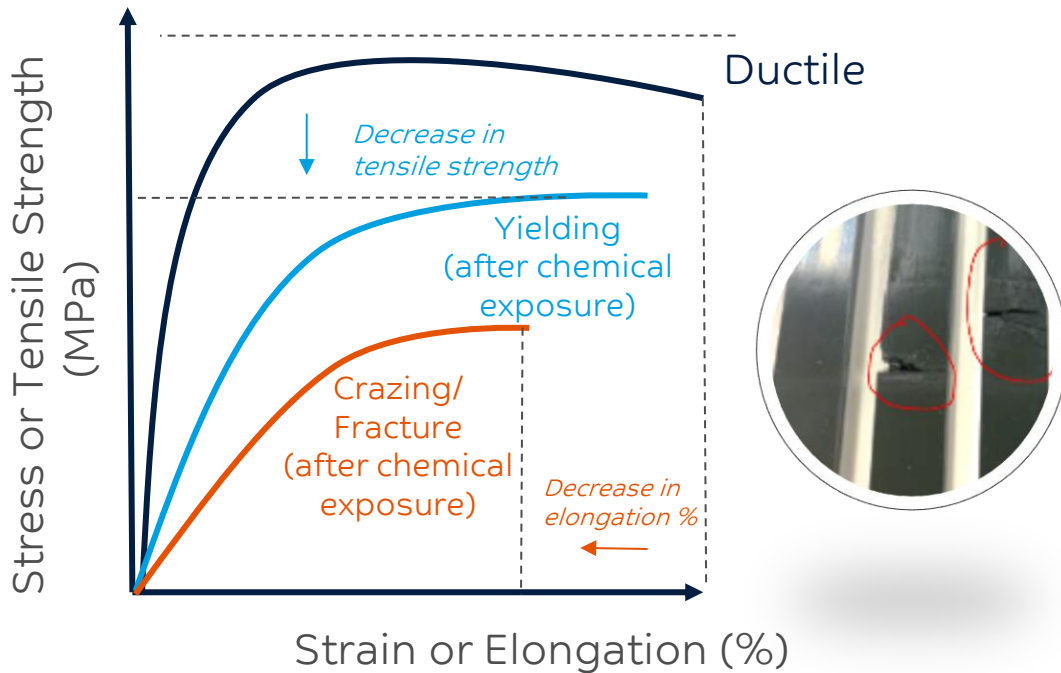
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# CHEMICAL COMPATABILITY

# UNDERSTANDING CHEMICAL COMPATIBILITY

When exposed to chemicals, plastic materials may undergo appearance and physical/ mechanical changes:

Illustrative example stress-strain curve



Color Rating	Tensile (% Retention)	Elongation (% Retention)
Compatible (C)	>90%	80-139%
Marginal (M)	80-89%	65-79%
Not Compatible (NC)	<79%	<65%-Embrittlement >140%-Plasticization

## APPEARANCE CHANGE

- Discoloration, color, or gloss shift

## PLASTICIZATION

- Can result in material softening, leading to an increase in weight
- Decrease in tensile strength and possible occurrence of yielding

## CRAZING

- Can result in localized fracturing
- Potentially a decrease in elongation at break

## SABIC'S SPECIALTIES ESC TESTING – GENERAL OVERVIEW

- The ESC\* test has been developed to screen candidate materials.
- No specific industry standard for conditions and interpretation.

Test bars are bent to specific strain levels (usually 0.5% or 1.0% in a test fixture)

Bars may be wrapped to ensure they are kept saturated while in contact with the strained area.



ASTM D543  
Retention %  
Tensile Stress @ Yield  
Tensile elongation @ Break

The bars are kept in constant exposure to the strain and chemical agent for a specified test period

### COMPATIBILITY RATING

Criteria	Yield stress Retention (%)	Elongation at break retention (%)
Compatible	> 90	80 – 139
Marginal	80 – 89	65 – 79
Not compatible	< 79	< 64 or > 140

- % Change is a good indicator of the chemical's severity as a stress cracking agent

➤ End users are responsible for determining the suitability of these products for their application requirements

# CHEMICAL RESISTANCE OF LNP™ ELCRES™ CRX COPOLYMER RESINS AGAINST TYPICAL HEALTHCARE CLEANING AGENTS \*

LNP ELCRES resins, can offer improved property retention after exposure to a range of typical healthcare disinfectants with different active components compared to industry-accepted solutions like FR PC, PC/ABS and PC/PBT resins

SABIC ESC Method: per ASTM D543	Strain level: 1% strain	Exposure condition: 23°C	Application: Saturation method	Exposure days	SANI-CLOTH® Bleach		SANI-CLOTH® AF3		SANI-CLOTH® plus		Diversey Oxivir® TB		Trichlorosynuric Acid		Virex® II 256		CIDEX® OPA Solution		Ethanol	
					σ <sub>y</sub>	ε <sub>b</sub>	σ <sub>y</sub>	ε <sub>b</sub>	σ <sub>y</sub>	ε <sub>b</sub>	σ <sub>y</sub>	ε <sub>b</sub>	σ <sub>y</sub>	ε <sub>b</sub>	σ <sub>y</sub>	ε <sub>b</sub>	σ <sub>y</sub>	ε <sub>b</sub>	σ <sub>y</sub>	ε <sub>b</sub>
FR PC/ABS		7			● ●	■ ■	■ ■	▲ ■	● ●	● ●	● ●	● ●	● ●	■ ■	● ●	■ ■	● ●	■ ■	● ●	■ ■
FR PC/PBT #		7			● ●	● ■	● ▲	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ▲	● ●	● ●	
EXL9330		7			● ●	■ ■	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ■	● ■	● ■	● ●	● ●	● ●	
CRX7412U		7			● ●	● ▲	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ▲	● ●	● ●	● ●	● ●	● ●	

Compatibility Criteria Color rating	Yield stress Retention, α <sub>y</sub> (%)	Elongation at break retention, ε <sub>b</sub> (%)
Compatible	> 90	80 – 139
Marginal	80 – 89	65 – 79
Not compatible	< 79	< 64 or > 140

Disinfectant	Type of Agent
SANI-CLOTH® Bleach, sodium hypochlorite	Halogen-releasing
SANI-CLOTH® AF3, SANI-CLOTH® Plus**, Virex® II 256	Quaternary ammonium salts
Diversey Oxivir® TB	Peroxygens
CIDEX® OPA solution	Aldehydes
Ethanol	Alcohol

<https://www.compoundchem.com/2016/03/11/antiseptics/>

\* This information should be used as indicative only. This is essentially a ranking test and is not intended to provide data to be used for design or performance prediction. Therefore, extensive testing of the finished part is strongly recommended. The performance and interpretation of end-use testing are the end producer's responsibility. \*\* also contains alcohol

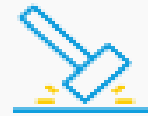
## INTRODUCING LNP™ ELCRES™ CRX & CXL COPOLYMER RESINS

**LNP™ ELCRES™ CRX & CXL resins** are a new family of polycarbonate copolymers that can offer improved chemical resistance. These resins are based on unique copolymer building block blends offering combination of:



### IMPROVED CHEMICAL RESISTANCE

Improved chemical resistance to range of chemical disinfectants



### IMPACT RETENTION

Retention of ductility upon exposure to chemicals



### PROCESSABILITY

Potential for high productivity molding and cycle time reduction



### FLAME RETARDANCY

FR performance - V0 up to 1.5 mm



### AESTHETICS

Consistent opaque color and appearance

LNPT™ ELCREST™ CRX RESINS

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# THE PORTFOLIO

# LNPT™ ELCREST™ NON-FR CRX COPOLYMER RESINS FOR MEDICAL DEVICES

## Amorphous Portfolio <sup>(1,2)</sup>

Notched Izod @ RT

UL Flame Rating

Renewable content Option <sup>(3)</sup>

Resin Grade	Appearance	Notched Izod @ RT (J/m)	UL Flame Rating	Renewable content Option <sup>(3)</sup>
CRX1414*	Opaque	875 J/m	HB @ 0.75 mm	53%
CRX1314T	Transparent	900 J/m	HB @ 0.75 mm	47%

## FEATURES



CHEMICAL RESISTANCE



IMPACT RETENTION



FLAME RETARDANCY



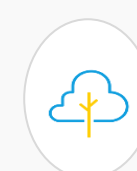
PROCESS-ABILITY



AESTHETICS (OPAQUE)



THIN WALL TRANSPARENCY



SUSTAINABILITY

\* A UV stabilized version, CRX1414U, is available

1. Limited biocompatibility assessment according to ISO 10993\* - parts 5 for toxicity and 10 for skin sensitization, part 23 for skin irritation Type I/II letters available for grades above  
 2. Option for Inclusion under SABIC's Healthcare Product Policy (formulation lock, management of change, surety of supply)  
 3. #based on the full exchange of fossil with all available renewable resins to give the bio-based versions

# TESTING THE COMPATIBILITY WITH HOSPITAL GRADE DISINFECTANTS

## HIGH SPEED PUNCTURE TEST: PC/ABS RESIN UPON EXPOSURE TO SANI-CLOTH® AF3

### PC/ABS: BRITTLE FRACTURE UPON 3 DAY EXPOSURE



BRITTLE FRACTURE



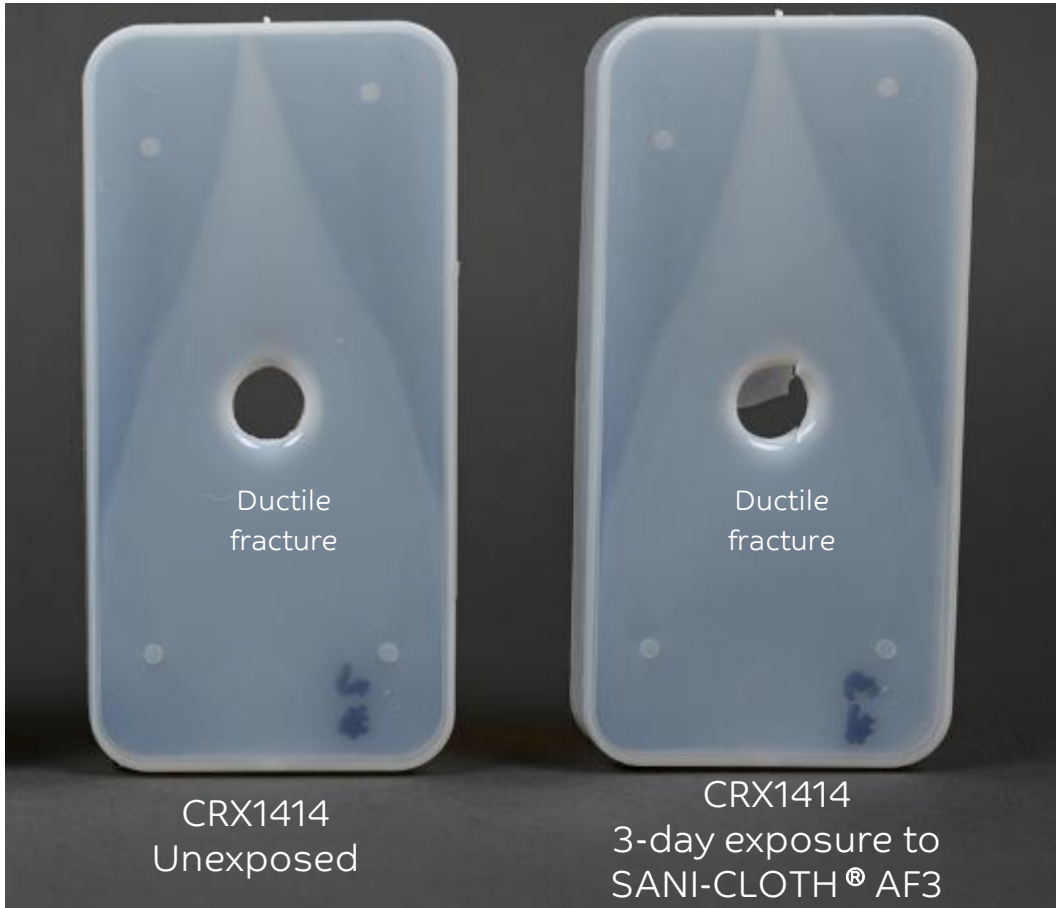
BRITTLE FRACTURE

(Part completely falls off the test jig!)

# TESTING THE COMPATIBILITY WITH HOSPITAL GRADE DISINFECTANTS

## HIGH SPEED PUNCTURE TEST: CRX1414 RESIN UPON EXPOSURE TO SANI-CLOTH® AF3

### CRX1414: DUCTILE FRACTURE UPON 3 DAY EXPOSURE

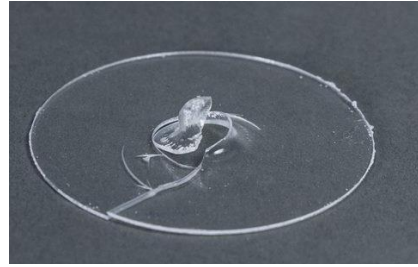


DUCTILE FRACTURE

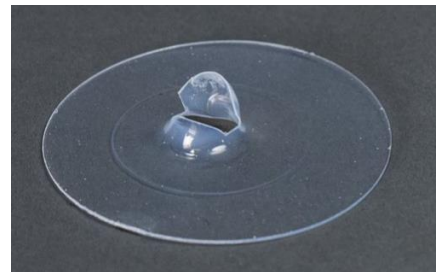


DUCTILE FRACTURE

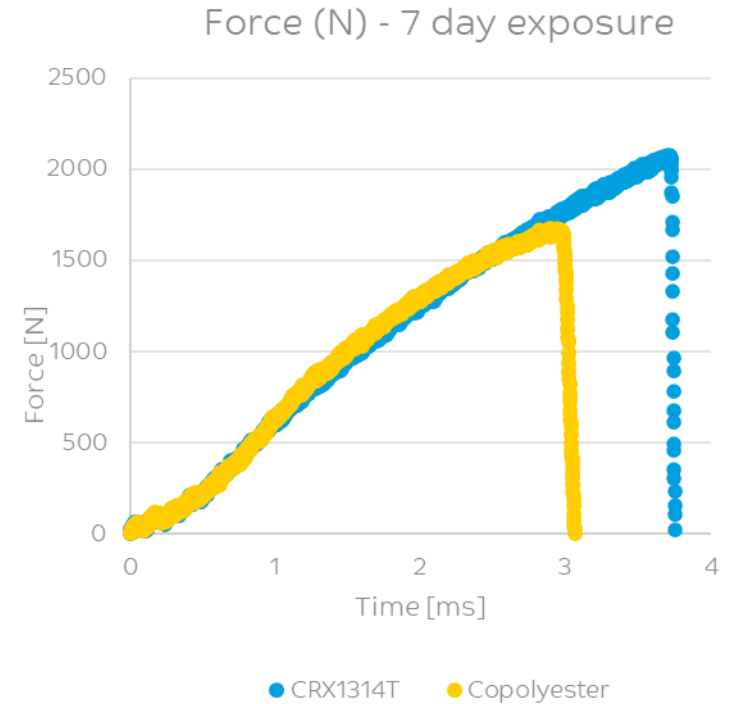
# HIGH SPEED PUNCTURE TEST COMPARISON AFTER 7-DAY EXPOSURE TO SANI-CLOTH® AF3



**BRITTLE** FRACTURE  
**LOWER** PEAK FORCE,  
**LOWER** PEAK ENERGY



**DUCTILE** FRACTURE  
**HIGHER** PEAK FORCE,  
**HIGHER** PEAK ENERGY



Material	Peak Force (N)	Peak Energy (J)
CRX1314T	2073	18.1
Copolyester	1676	12.2

LNPT™ ELCREST™ CRX RESINS

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# THE FLAME RETARDANT PORTFOLIO

# LNPT™ ELCREST™ FR CRX COPOLYMER RESINS FOR MEDICAL DEVICES



Grade	Impact	UL Flame Rating	Flow / ESCR	
CRX7412U	Opaque	670 J/m	V0 @ 1.2 mm	12 / ✓
<b>NPCR9612U</b>	Opaque	750 J/m	V0 @ 1.5 mm	7 / ✓+

High-performance materials to meet evolving needs of improved chemical resistance against a broad range harsh disinfectants and chemicals, in order to improve the device durability. Innovating to address the regulations and trends on SVHC without compromising on performance.

✓+ denotes best in class ESCR performance

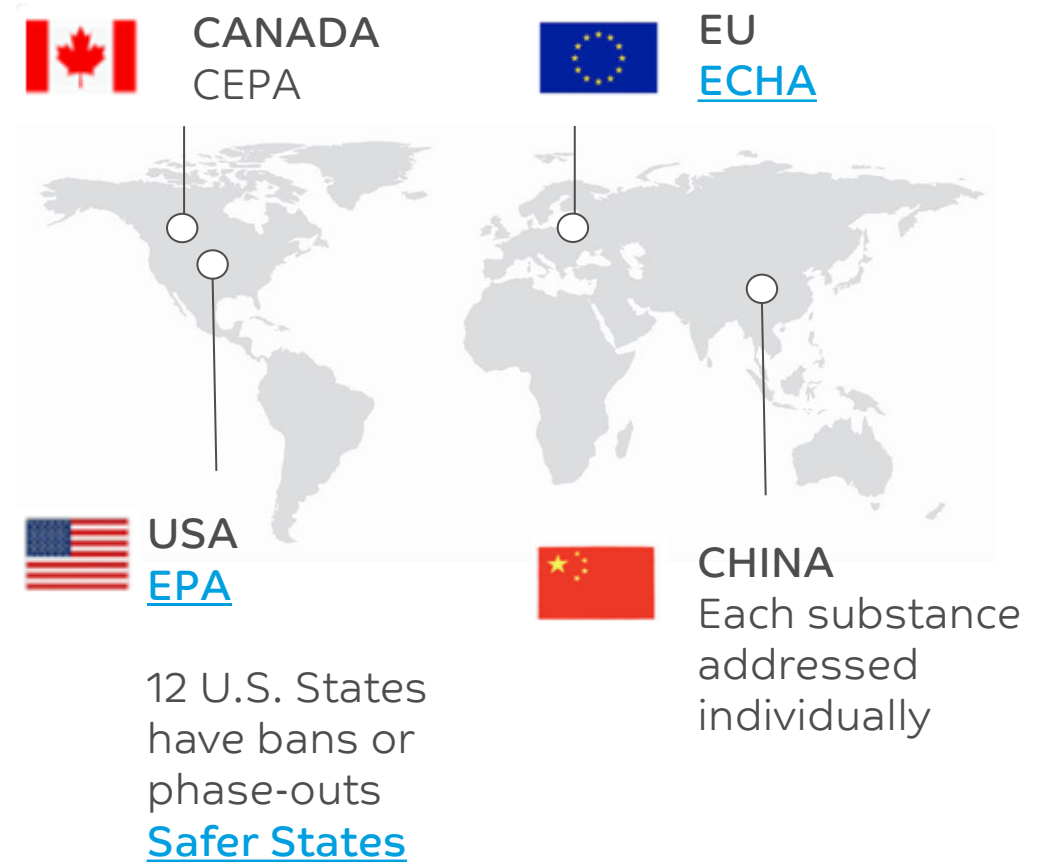
Non-Br / Cl FR  
NON-PFAS FR (UL746G Certified)

# PFAS REGULATIONS COULD RESULT IN GLOBAL SUPPLY UNCERTAINTY



Per- and polyfluoroalkyl substances include PFOA, PFOS, and other fluorinated chemicals (also known as PFAS or Fluorotechnology)

## WHO IS CONSIDERING PFAS REGULATIONS



# NIA-PFAS PRODUCT POSITIONING

## Current NIA-PFAS Portfolio

1300+ grades



NIA-PFAS mentioned on TDS



Searchable on Material Finder



Product Stewardship Declaration

### Standard Product Declaration

SABIC product does not contain substances as intentionally added components

We disclose to the best of our knowledge and analysis of substances on a routine basis **is not part** of a control plan or Product Specification

## New UL Certified Non-PFAS Portfolio

~13 grades\*



NIA-PFAS mentioned on TDS



Searchable on Material Finder



- ✓ 3<sup>rd</sup> party trusted certification
- ✓ Searchable on UL website
- ✓ NP nomenclature\*

\* NP nomenclature not applied to LNPT™ Wear and Friction resins

# THE ELECTRO & AUTOMOTIVE MARKET: DURABILITY TO WIPE AND DISINFECTION

# APPLICATIONS NEED CHEMICAL RESISTANCE IMPROVED SOLUTIONS

CXL\*\*\*\*  
All others



WALKWAKIE DEVICE



WEARABLE DEVICES



EVSE RELATED DEVICE



TABLET & CELL PHONE



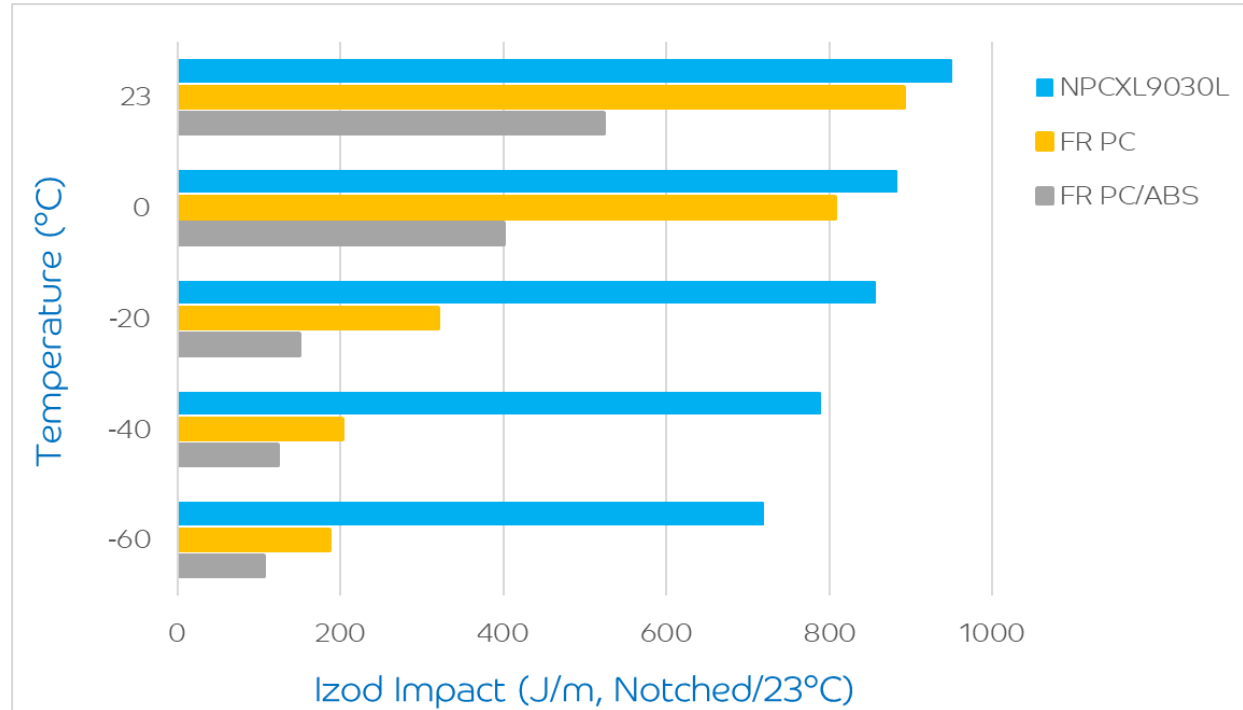
BATTERY HOUSING



VR/GAMING DEVICES

# LOW TEMPERATURE IMPACT DURABILITY PERFORMANCE OF LNPT™ ELCREST™ NPCXL9030 & CXL9030L RESINS VERSUS ALTERNATIVES

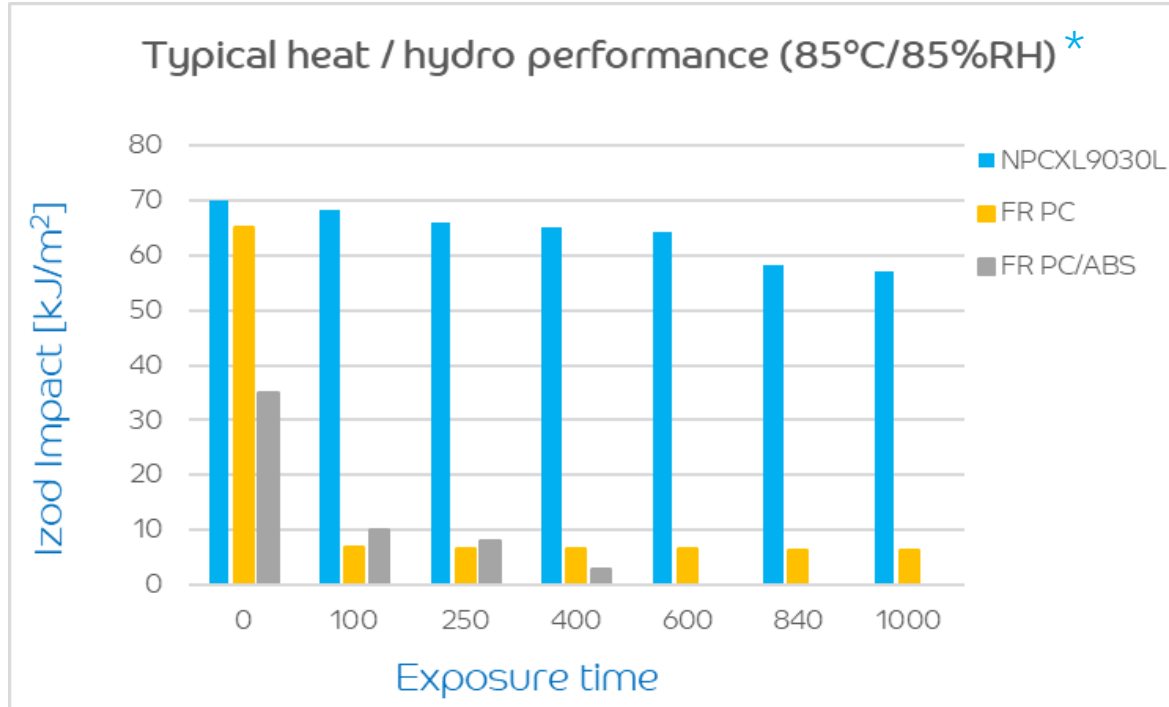
## Impact vs Temperature



➤ NPCXL9030L delivers low temperature ductility down to -60°C, with a UL746C f1 rating

# HEAT / HYDRO DURABILITY PERFORMANCE OF LNPT™ ELCRES™ NPCXL9030 & CXL9030L RESINS VERSUS ALTERNATIVES

## Weathering



➤ NPCXL9030L exhibits excellent heat/hydro stability of the high impact performance

\* The results depend on the impact norm, thickness, color

# CHEMICAL RESISTANCE OF LNPT™ ELCRES™ CXL9730E COPOLYMER RESIN AGAINST AUTOMOTIVE, BIKE MAINTENANCE & PERSONAL CARE CHEMICALS

SABIC ESC Method: per ASTM D543 Exposure days: 5 Exposure condition: 23 C Application: Saturation method	Autan (DEET)	Nivea sun cream	Banana Boat (30 SPF)	Electrolyte	Chain cleaner (MUC-OFF Drivetrain)	Tar remover	Washing gasoline	Gasoline (Coleman)	Rim cleaner (Sonax velgenreiniger)	Brake fluid (DOT 5, silicone based)
Strain level (%)	1.0	1.0	1.0	0.5	1.0	0.5	1.0	1.0	1.0	1.0
PRODUCT	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$	$\sigma_y \epsilon_b$
FR PC/ABS	■ ■	■ ■	■ ■	▲ ■	● ■	● ■	● ■	■ ■	■ ■	■ ■
FR PC	■ ■	■ ■	■ ■	■ ■	■ ■	▲ ■	● ▲	● ▲	● ▲	● ●
CXL9730E	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●



➤ NPCXL9030L exhibits enhanced resistance against a range of chemicals, reducing the risk of premature stress cracking in applications

# LNPT™ ELCREST™ FLAME RETARDANT EXL AND CXL RESINS WITH V0 AT 1.5MM FOR INDUSTRIAL & MOBILITY

## EXL



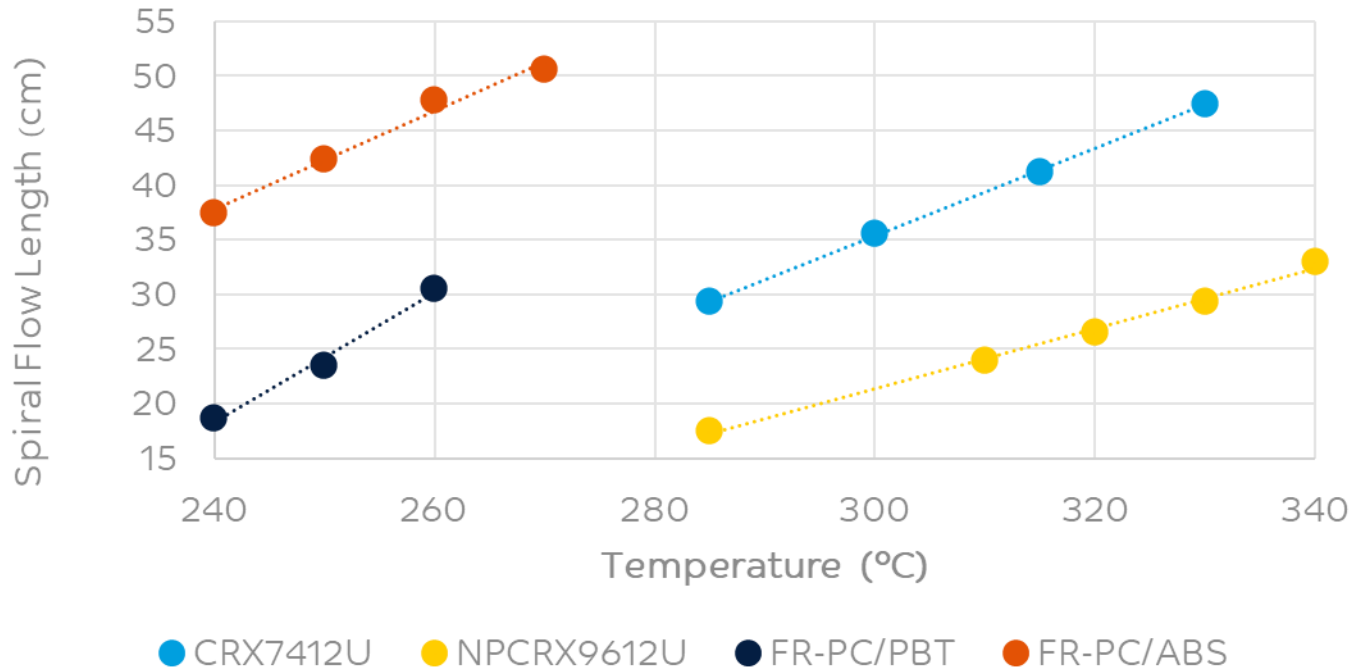
Grade	MVR	Notes
CXL9730E	4	Extrusion grade. V0 @ 1.5mm in black color, 5VA @ 3mm, RTI 125/110/120°C, F1
CXL9030	7	V0 at 1.5mm, 5VA at 3mm, medium flow, RTI 125/110/120°C, F1, -60°C ductility
NPCXL9030L	7	V0 at 1.5mm, medium flow, RTI 125/110/120°C, F1, -60°C ductility

CXL resins are high-performance materials, well suited to meet customer demands for top-class resistance to chemicals ranging from sunscreen and hand or insect repellent creams and industrial oils and greases in combination with LT ductility, and outdoor durability.

# PART DESIGN AND PROCESSING CONSIDERATIONS

# PROCESSING OF LNP™ ELCRES™ CRX RESINS COMPARED TO TYPICAL ALTERNATIVE RESINS

LNP ELCRES CRX7412U resin offers good chemical resistance with high flow comparable to typical FR PC/ABS and PC/PBT alternatives, while LNP ELCRES NPCRX9612U offers enhanced wipe & disinfection durability in a medium flow material.



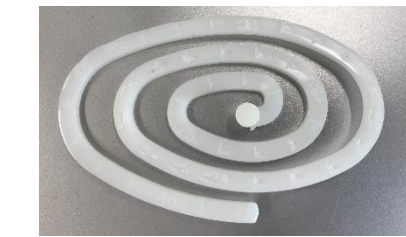
CRX7412U – 310°C



NPCRX9612U – 330°C



FR-PC/PBT – 250°C



FR-PC/ABS – 250°C

2.0 mm at 2000bar

LNP ELCRES resins can potentially serve as direct replacements for alternative resins in existing tooling when used under the correct processing conditions.

(Detailed processing and shrinkage studies are available upon request via your SHPP contact person)

## COLOR STABILITY OF LNP™ ELCRES™ NPCRX9612U AND CRX7412U RESINS

LNP ELCRES NPCRX9612U and CRX7412U have been shown to provide good color and molecular weight retention when molded under higher conditions like melt temperature up to 330°C and/or long residence times up to 12 minutes

Color Shift White color	Residence time			
	Mold T (°C)	4 min	12 min	16 min
290		Green	Green	Green
310		Green	Green	Green
320		Green	Green	Light Green
330		Green	Light Green	Light Green
340		Green	Light Green	Yellow

$dE \leq 0.3$ 
  $0.3 < dE \leq 0.5$ 
  $dE \geq 0.6$

The optimization of the molding conditions to avoid molded in-stress and consequently a likely reduction in ESC performance is essential for LNP ELCRES CRX resins

LNPT™ ELCRINT™ CRX RESINS

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RENEWABLE OPTIONS

LNP ELCRIN CRX7412UB RESIN

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## SABIC SPECIALTIES BUSINESS RENEWABLE FEEDSTOCK



- **Second generation feedstock**, not in competition with food chain
- Non-fossil based
- **Derived from waste or residue**, such as crude tall oil from the wood industry (pulp & paper) and HVO\*
- Externally **certified value chains**
  - ISCC plus
  - **FSC® and PEFC™ sustainable forest management certifications** for UPM forests (applies to bio-naphtha from crude tall oil)



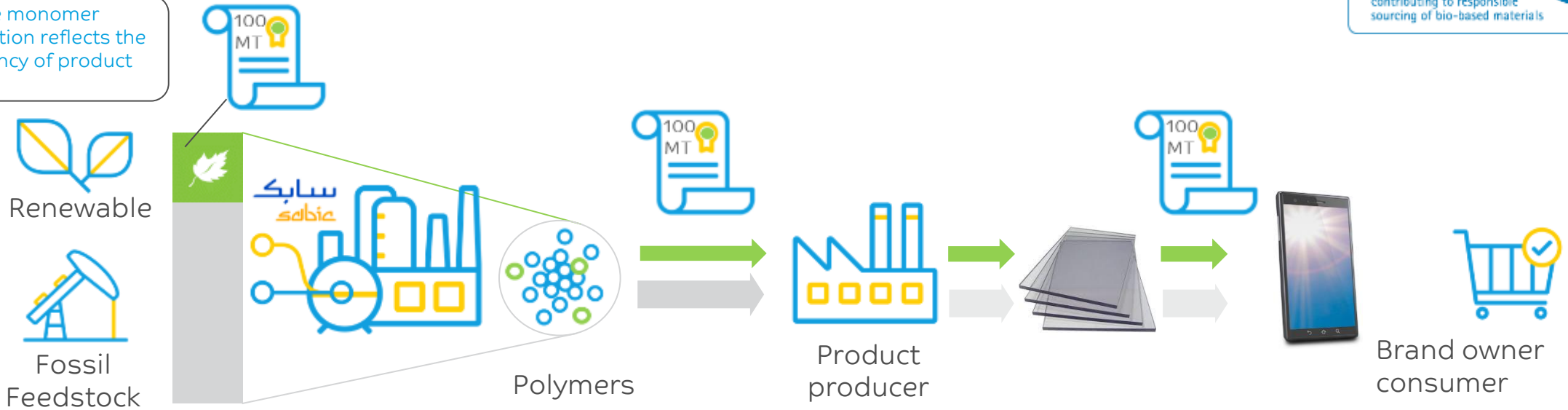
RENEWABLE  
FEEDSTOCK

# MASS BALANCE - CHAIN OF CUSTODY AND LNP™ ELCRIN™ CRX7412UB RESIN

## SHPP ISCC+ CERTIFIED RENEWABLE PC and COPOL SOLUTIONS

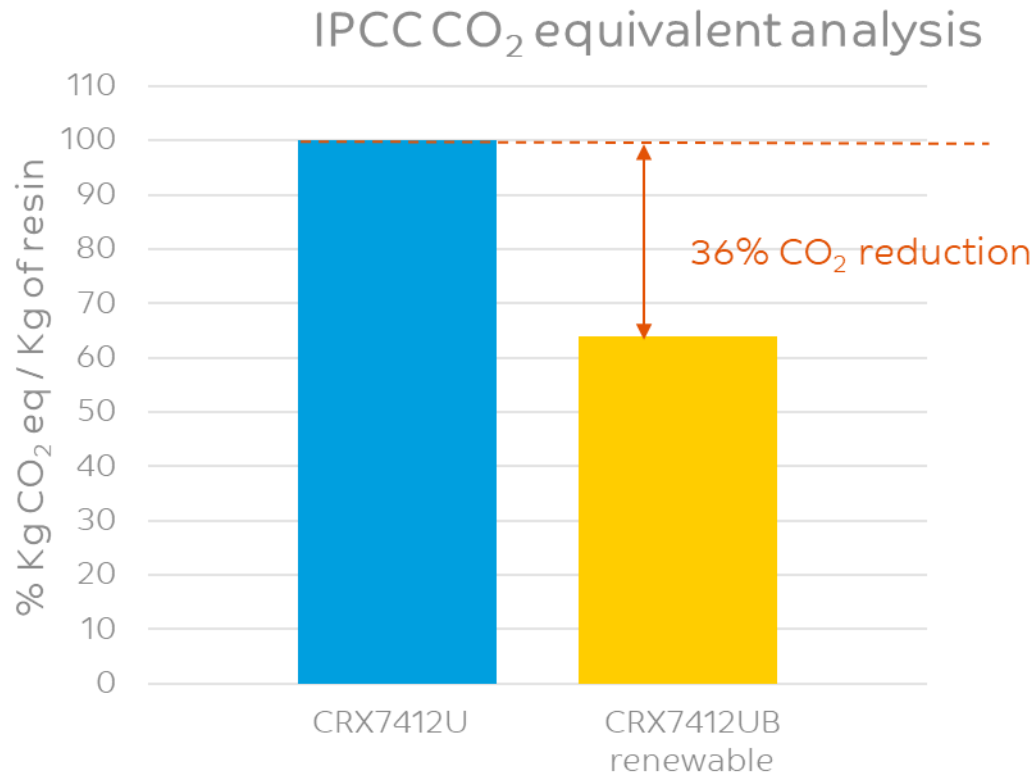


From the monomer composition reflects the consistency of product quality



**LNP ELCRIN CRX7412UB resin** -for every **100kg** of this Polycarbonate product, **48 kg** of oil-based materials have been replaced by renewable materials.(Based on Mass Balance approach)

# RENEWABLE BASED LNP™ ELCRIN™ CRX7412UB RESIN



Renewable ELCRIN versions can be made available for all CRX resins

LNP ELCRIN CRX7412UB resin provides OEMs and consumers the potential to “further improve” the environmental performance through the incorporation of renewable feedstock that is based on non-fossil, bio-based content from waste materials, without compromising on performance

## RENEWABLE COMPOUNDS COMPARED WITH CONVENTIONAL COMPOUNDS



Same product, same properties:  
Potential drop in solution with no tooling changes



Better carbon/energy footprint



Equivalent color space



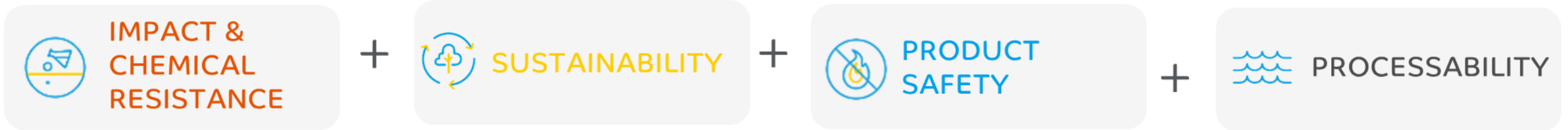
Requalification not required

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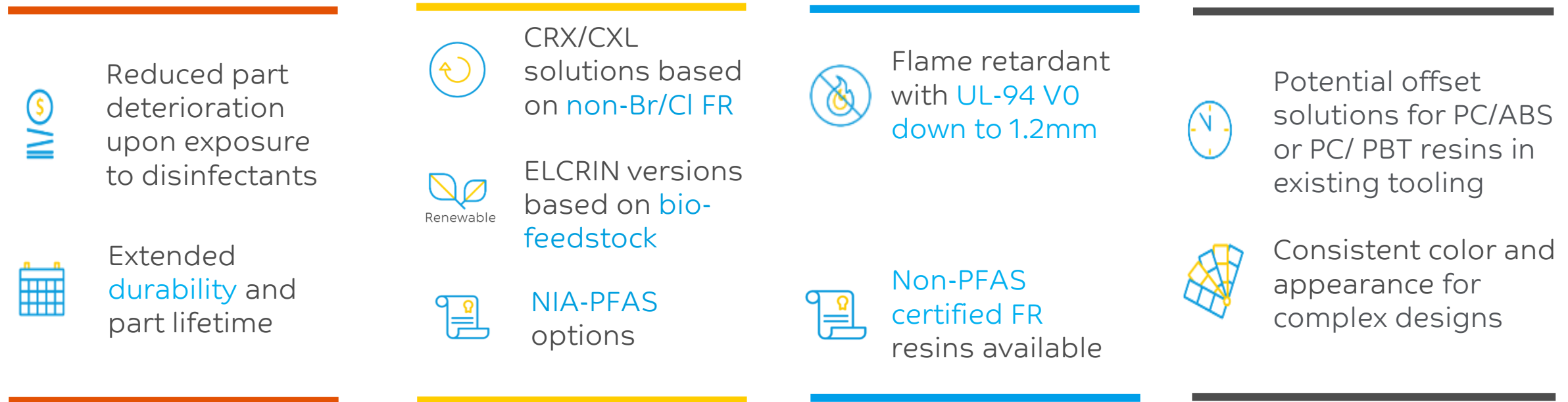
# SUMMARY

# LNPT™ ELCRES™ & ELCRIN™ CRX / CXL COPOLYMER RESINS

## FEATURES:



## POTENTIAL BENEFITS:



## DISCLAIMER

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