

CHEMISTRY THAT MATTERS™



# NON-PTFE LNP™ LUBRILOY™ COMPOUNDS & DEVELOPMENT

HELPING MEDICAL DEVICE MANUFACTURERS MEET PFAS REGULATIONS

Yuanqing Emily He, Senior Business Manager, SABIC Polymers, Specialties Business Unit  
MGMC Mini Conference, August 27, 2025

# AGENDA

---

1 SABIC AND LNP™ SPECIALTY COMPOUNDS

2 PFAS REGULATIONS AND IMPACT

3 WEAR AND FRICTION INTRO

4 LNP™ LUBRILLOY™ NEW PRODUCTS AND DEVELOPMENT

5 Q&A



## SABIC IS A PREFERRED GLOBAL SUPPLIER FOR OVER THREE DECADES



1976

Company established



≈ 31,000

Employees around the world



140

Countries served



≈ 11,000

Global patents and pending applications



Top 2

Chemical Brand Value\*

4.9

US\$ bn

Estimated Brand Value\*

78.5

US\$ bn

Total assets

0.35

US\$ bn

Net income from continuing operations

37.7

US\$ bn

Annual revenue



≈ 150

New products each year



63

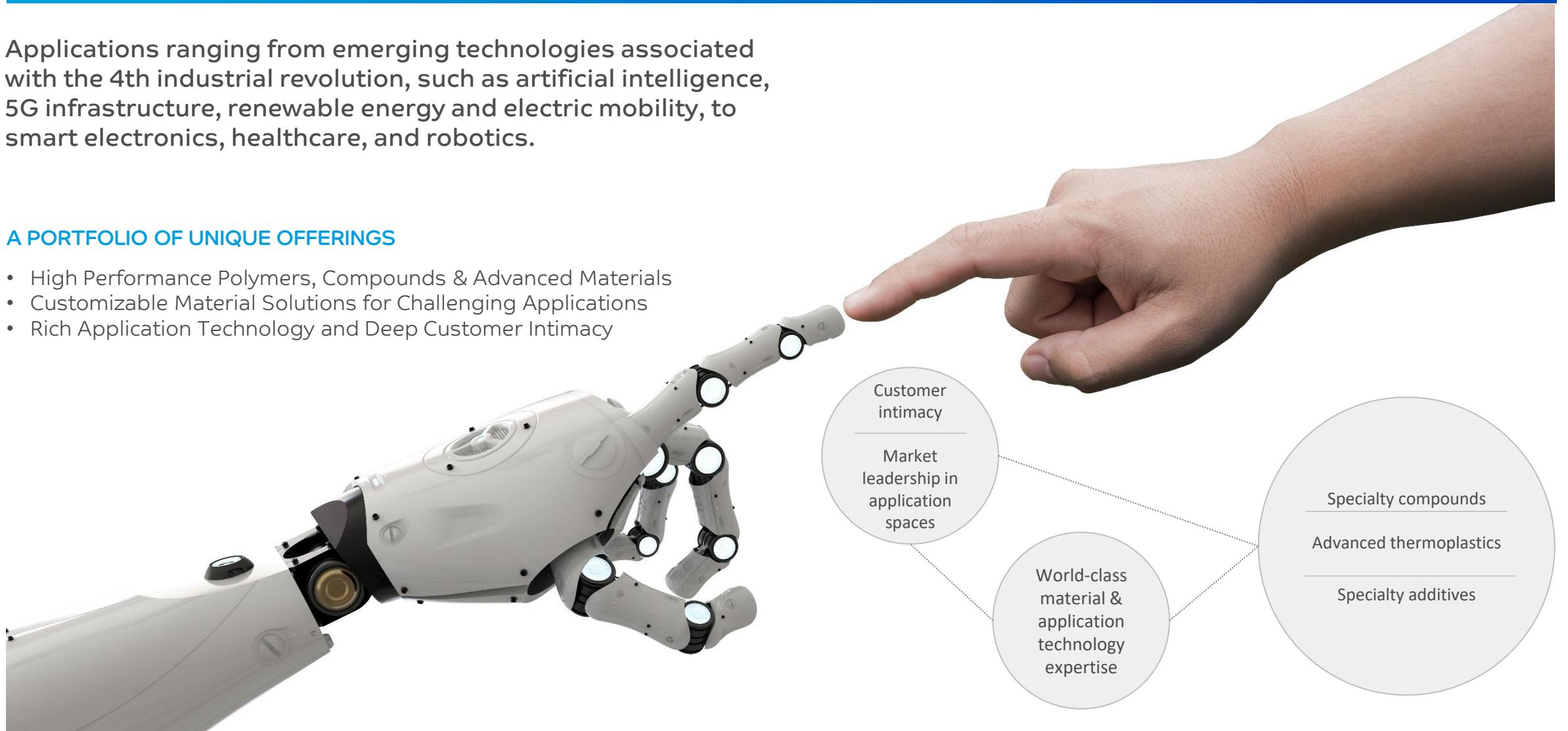
World-class plants worldwide

## COLLABORATING WITH OUR CUSTOMERS TO CREATE THE FUTURE

Applications ranging from emerging technologies associated with the 4th industrial revolution, such as artificial intelligence, 5G infrastructure, renewable energy and electric mobility, to smart electronics, healthcare, and robotics.

### A PORTFOLIO OF UNIQUE OFFERINGS

- High Performance Polymers, Compounds & Advanced Materials
- Customizable Material Solutions for Challenging Applications
- Rich Application Technology and Deep Customer Intimacy



# LNP™ COMPOUNDS OFFER A MULTITUDE OF EFFECTS

**LNP™**  
compounds  
Beyond the resin

Modifying and enhancing the properties of thermoplastics for the desired effects to expand the horizon of engineering applications

## STRUCTURAL

- Dimensional accuracy
- High modulus & ductile (HMD)
- Super structural
- Metal replacement
- Nano molding (NMT)
- Recycle & renewable solutions



**TARGET APPLICATIONS**  
Structural parts found in automotive, business machines, appliances, consumer electronics, building & construction ...

## WEAR & FRICTION

- Noise abatement
- Lubrication
- Durability
- Low maintenance



**TARGET APPLICATIONS**  
Wear / counter-wear parts in automotive, fluid engineering, business machines, **healthcare**, consumer electronics...

## ELECT. CONDUCTIVE

- SR from 10E<sup>3</sup> to 10E<sup>12</sup>
- Static management
- Electronics protection



**Target applications**  
Electrostatic discharge (ESD) safe parts in automotive, business machines, E&E, consumer electronics, healthcare and industrial products...

## EMI SHIELDING

- Wide frequency range
- Colorable
- Paintable
- No secondary process



**Target applications**  
Enclosures requiring EMI / RFI shielding found in telecom, consumer electronics, safety & security and industrial products...

## THERMAL MANAGEMENT

- Thermal dissipation
- Dimensional stability
- Electrically conductive; electrically isolative



**Target applications**  
Parts in various industries requiring heat dissipation for product performance reliability and product life-span extension.

## CIRCUIT SOLUTIONS

- MID – LDS (Laser Direct Structuring)
- Selective metal plating
- High Dk, Low Df substrates

- Dielectrics**
- Low Df(Dielectric losses)
  - High/Low Dk



**Target applications**  
Base station phase shifter, antenna housing, substrate, OIS camera...

## SUSTAINABILITY

- iQ PBT - Upcycled post-consumer PET
- Bio-based PC



**Potential applications** where there is a desire to have a reduction in energy generated to produce such product with a lower carbon footprint.

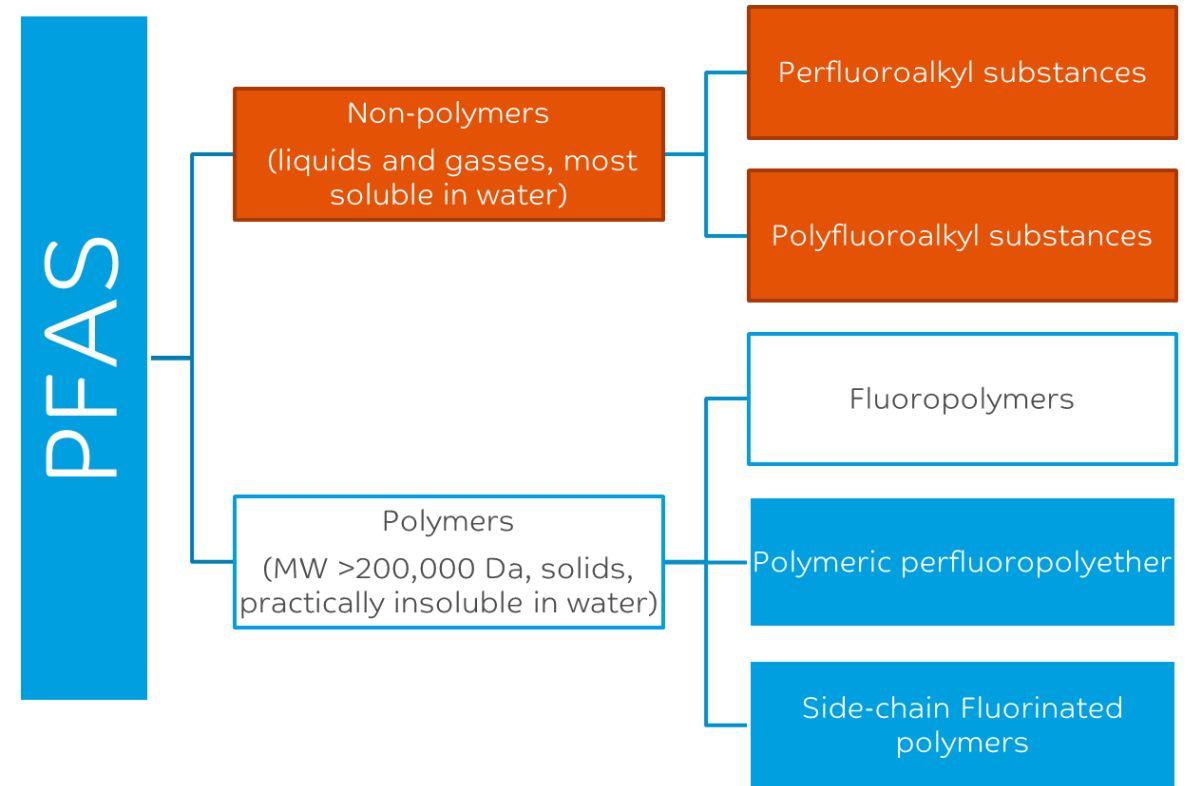
---

# PFAS REGULATIONS AND IMPACT

## PFAS IN REGULATIONS - OVERVIEW

PFAS (Per- and polyfluoroalkyl substances) are a group of man-made chemicals that includes PFOA, PFOS, GenX, and other fluorinated chemicals.

- Strong C-F bonds
- Tight limitations on amount of PFOA and related chemicals in articles sold in Europe (2020).
- Recently, ECHA proposed a regulation that would limit use of PFAS in Europe (2023)
- Several individual states in the USA also implemented similar regulations.



- Broadest definition is any chemical containing a fully fluorinated carbon atom. Not all regulatory and standards bodies use this definition.
- Most definitions and lists include polymeric materials like PTFE and PFPE

## SABIC MATERIAL OPTIONS MEETING PFAS REGULATIONS



### 1300+ NIA-PFAS GRADES

NO PFAS INTENTIONALLY ADDED  
Noted on SABIC TDS

- The grade does not contain PFAS intentionally added during SABIC's manufacturing process and is not expected to contain unintentional PFAS impurities.
- Each user is responsible for evaluating the presence of unintentional PFAS impurities.
- Product declaration available on request.



### 13+ UL746G-CERTIFIED GRADES

3<sup>rd</sup> PARTY TRUSTED CERTIFICATION  
Published on UL Yellow Cards

- UL746G is an outline of investigation for non-fluorine and non-PFAS containing materials from Underwriters Laboratories.
- New NP\* portfolios across products.
- Searchable on UL website.

\* NP nomenclature not applied to LNPT<sup>™</sup> LUBRILLOY<sup>™</sup> or LUBRICOMP<sup>™</sup> Wear and Friction compounds

## SABIC MATERIAL OPTIONS MEETING PFAS REGULATIONS

### PFAS-CONTAINING MATERIALS

### SABIC MATERIAL OPTIONS MEETING PFAS REGULATIONS



#### FLAME RESISTANT THERMOPLASTICS

Certain resins (PC, PC/ABS, ABS) use PFAS-based additives to achieve certain flame resistance characteristics.

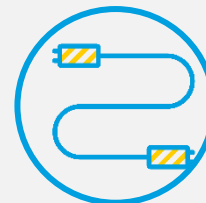
ULTEM™ resins  
 NORYL™ resins  
 LNP™ ELCREST™ resins



#### INTERNALLY LUBRICATED THERMOPLASTICS

PTFE, a PFAS-containing fluoropolymer, is one of the most widely used internal lubricant for compounded thermoplastics.

LUBRILOY™ compounds



#### HIGH PERFORMANCE WIRE & CABLE

PFAS-containing fluoropolymers PVDF, ETFE, and FEP are used in diverse applications due to their durability (heat, dielectric, chemical, and UV resistance).

SILTEM™ resins  
 ULTEM™ resins

---

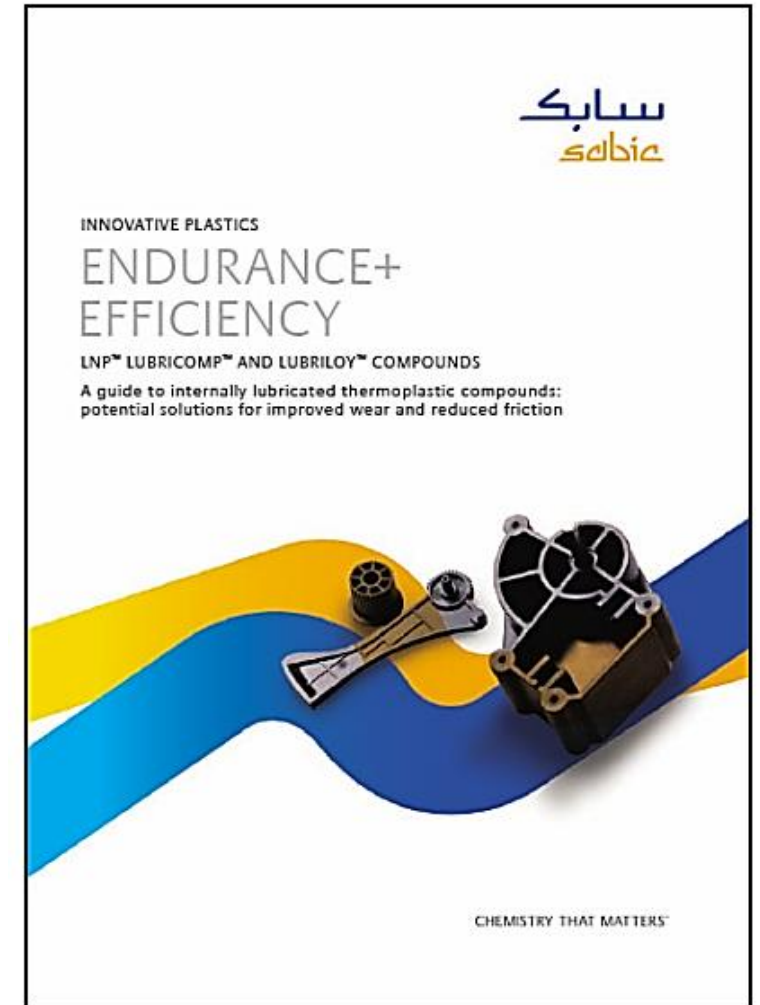
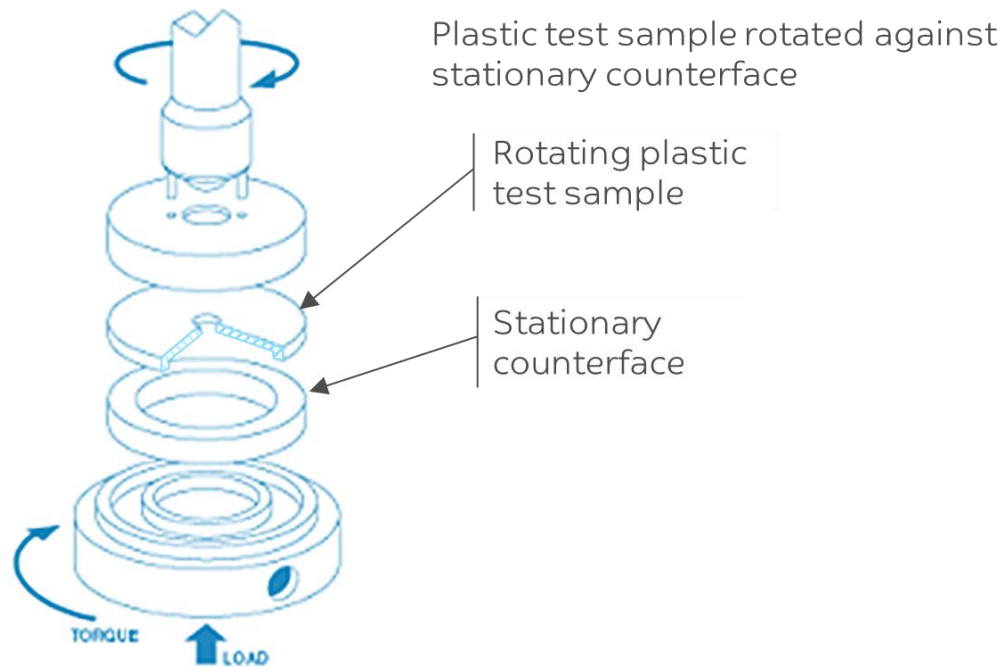
SETTING THE SCENE:

# WHAT IS WEAR AND FRICTION AND WHY IS IT IMPORTANT

## WEAR AND FRICTION TERMINOLOGY

### Communicating performance: LNP™ compounds wear factor $K_{LNP}$

- Wear Factor  $K_{LNP}$  ( $10^{-10}$  in 5-min/ft-lb-hr) is a measure of resistance to wear -
- The lower the value, the lower the amount of wear
- Use to compare relative wear resistance
- Generated using modified ASTM D3702 test method



## ALTERNATIVE LUBRICATION TECHNOLOGY INCLUDES NON-PTFE SOLUTIONS

### POLYMERIC ALLOYS LNP™ LUBRILOY™ Compounds

- LNP LUBRILOY compounds can offer **many of the same performance features as PTFE**, including colorability.
- **New technology** can offer **PTFE-like wear and friction performance in higher temperature resins.**

### SILICONE

- Provides good wear against **metal but primarily used for friction reduction.**
- Very **short break-in time.**

### GRAPHITE

- Effective in reducing wear and friction but **limited to black in color.**

### MOLYBDENUM DISULFIDE

- Typically used in **polyamides.**
- Helps eliminate slip-stick in bearings and bushings.

---

# LNP<sup>TM</sup> LUBRILLOY<sup>TM</sup> NEW COMPOUNDS & DEVELOPMENT

## LNP™ LUBRILOY™ COMPOUNDS PORTFOLIO

### LNP LUBRILOY COMPOUNDS FEATURES:

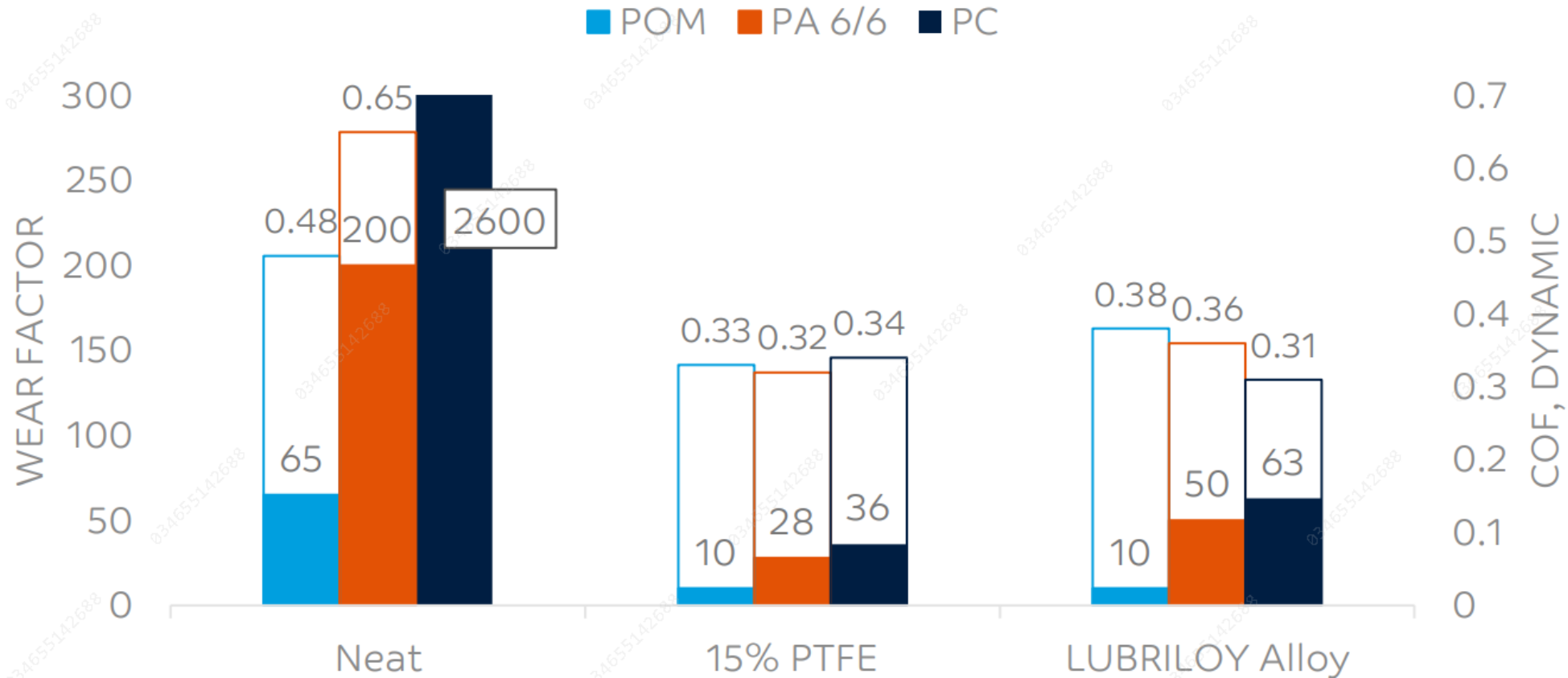
- Non-halogenated lubrication
- Improved impact over PTFE filled materials
- Lower mold deposits
- Excellent surface finish & color ability
- Lower S.G. vs. PTFE filled materials

without the use of PTFE, a PFAS containing material.

	GRADE	DESCRIPTION
Nylon 6/6	• R2000	– General purpose grade
	• R2000A	– Maximized wear and friction performance
	• R2000AXP	– Improved mechanical properties
	• R2000I	– High impact, abrasion resistant
	• RF206XXH	– 30% glass fiber reinforced
PC	• D2000	– General purpose grade
	• D2000AXH	– Healthcare grade
	• DF206XXH	– 30% glass fiber reinforced Healthcare grade
PC/ABS	• N2000	– General purpose grade
PBT	• W8000	– General purpose grade
PPA	• U2000A	– General purpose grade
	• UF206/UF206A	– 30% Glass fiber reinforced
PPO	• Z2000	– General purpose grade
	• Z20001	– UL94-V0, ECO-FR
POM	• K2000	– General purpose grade
	• K2000XXH	– Healthcare grade
	• K8000XXL	– Food contact grade

# LUBRICATED PERFORMANCE COMPARISON - LNP™ LUBRILLOY™ COMPOUNDS

Thrust washer wear vs. steel (50 fpm, 40 psi, RT)



➤ New LUBRILLOY products based on POM, PA6/6 and PC showed comparable lubricated performance vs 15% PTFE containing products

# LNP™ LUBRILLOY™ RESINS - NEW DEVELOPMENT FOR HEALTHCARE APPLICATION

			Wear Factor (K, ASTM D 3702)	Coefficient of Friction (ASTM D 3702)	HDT, 1.82MPa (°C, ASTM D 648)	Tensile Modulus (MPa, ASTM D 630)	
LUBRILLOY™ new development for HC	PEEK base	Unfilled	ER076917	69	0.29 (dynamic) 0.37 (static)	148	3543*
		Unfilled	ER018820	85	0.29 (dynamic) 0.31 (static)	190	3078
	PEI base	Glass fiber reinforced	ER018801	76	0.38 (dynamic) 0.58 (static)	212	8930

➤ New LUBRILLOY product development\* for healthcare applications based on PEEK and PEI resin – including unfilled and glass fiber reinforced for high stiffness performance

\* Experimental grades available for sampling with a signed sample letter

## LNP™ LUBRILLOY™ RESINS NEW DEVELOPMENT - PEI RESIN (UNFILLED)

PROPERTIES	STANDARD	UNIT	LUBRILLOY ER018820*	LUBRICOMP™ EL003 (15% PTFE)
Tensile Modulus, 50 mm/min	ISO 527	MPa	3078	-
Tensile Stress, brk, Type I, 50 mm/min	ISO 527	MPa	88	82
Tensile Stress, yld, Type I, 50 mm/min	ISO 527	%	97	83
Flexural Modulus, 1.3 mm/min, 50 mm span	ISO 178	MPa	3090	3020
Izod Impact, notched, 23°C	ISO 180	kJ/m <sup>2</sup>	70	69
HDT, 1.82 MPa, unannealed	ISO 75	°C	190	182
Wear Factor (K)	ASTM D3702 Modified: Manual	K <sub>LNP</sub>	85	106
Dynamic COF	ASTM D3702 Modified: Manual	-	0.29	0.3

Development with non-PTFE lubrication in PEI has shown similar properties to PTFE lubrication.

COLLABORATE TO GROW - INNOVATE TO WIN

## SABIC' SPECIALTIES BUSINESS CAN OFFER

- Advice in material selection
- New material solutions – including sustainable offerings
- Application development support



SABIC MATERIAL FINDER  
Find the Specialties material well  
suited for your application



## DISCLAIMER

---

THE MATERIALS, PRODUCTS AND SERVICES OF SAUDI BASIC INDUSTRIES CORPORATION (SABIC) OR ITS SUBSIDIARIES OR AFFILIATES (“SELLER”) ARE SOLD SUBJECT TO SELLER’S STANDARD CONDITIONS OF SALE, WHICH ARE AVAILABLE UPON REQUEST. INFORMATION AND RECOMMENDATIONS CONTAINED IN THIS DOCUMENT ARE GIVEN IN GOOD FAITH. HOWEVER, SELLER MAKES NO EXPRESS OR IMPLIED REPRESENTATION, WARRANTY OR GUARANTEE (i) THAT ANY RESULTS DESCRIBED IN THIS DOCUMENT WILL BE OBTAINED UNDER END-USE CONDITIONS, OR (ii) AS TO THE EFFECTIVENESS OR SAFETY OF ANY DESIGN OR APPLICATION INCORPORATING SELLER’S MATERIALS, PRODUCTS, SERVICES OR RECOMMENDATIONS. UNLESS OTHERWISE PROVIDED IN SELLER’S STANDARD CONDITIONS OF SALE, SELLER SHALL NOT BE RESPONSIBLE FOR ANY LOSS RESULTING FROM ANY USE OF ITS MATERIALS, PRODUCTS, SERVICES OR RECOMMENDATIONS DESCRIBED IN THIS DOCUMENT. Each user is responsible for making its own determination as to the suitability of Seller’s materials, products, services or recommendations for the user’s particular use through appropriate end-use and other testing and analysis. Nothing in any document or oral statement shall be deemed to alter or waive any provision of Seller’s Standard Conditions of Sale or this Disclaimer, unless it is specifically agreed to in a writing signed by Seller. Statements by Seller concerning a possible use of any material, product, service or design do not, are not intended to, and should not be construed to grant any license under any patent or other intellectual property right of Seller or as a recommendation for the use of any material, product, service or design in a manner that infringes any patent or other intellectual property right.

SABIC and brands marked with <sup>TM</sup> are trademarks of SABIC or its subsidiaries or affiliates.

© 2025 Saudi Basic Industries Corporation (SABIC). All Rights Reserved.

Any brands, products or services of other companies referenced in this document are the trademarks, service marks and/or trade names of their respective holders.



THANK YOU

