CHEMISTRY THAT MATTERS™

# ADVANCED LNP™ SOLUTIONS FOR PLASTIC GEARS

MARCH 2020

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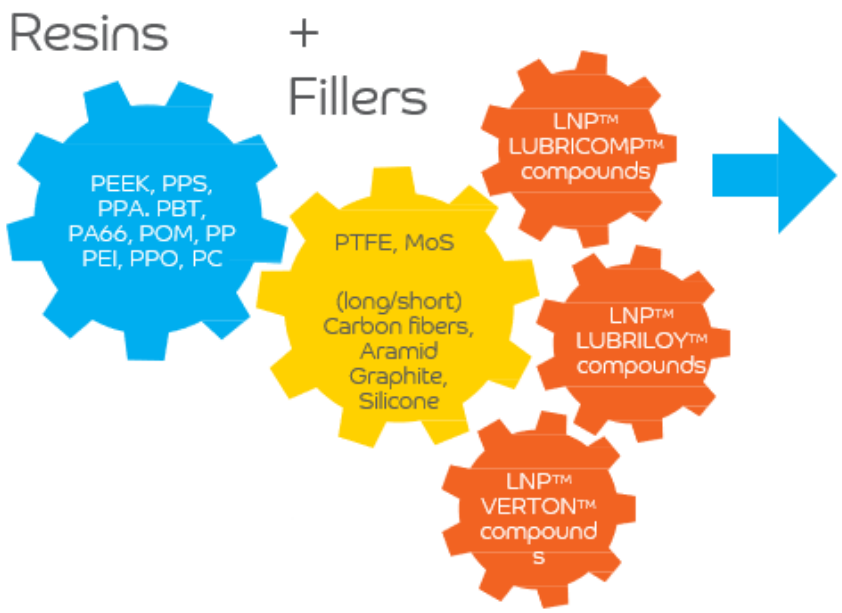



## Gears Features

1. High Heat
2. High Torque
3. Accuracy
4. Noise reduction
5. Wear resistance

## SABIC™ SUPPORT

**Material data availability**

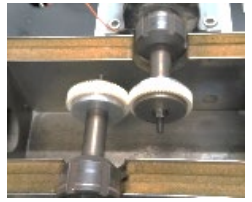
- Static strength [ISO 178 / 527]
- Static stiffness [ISO 178 / 527]
- Gear fatigue strength [VDI 2736]
- Wear coefficient [ASTM D3702]
- Physical data / CLTE

**Address failure mode**

- Tooth thinning
- Tooth fracture
- Tooth deformation
- Transmission error

**Gear optimization**

- Material selection
- Gear design optimization
- Service life prediction
- Noise reduction



KISSSOFT
Calculation programs for machine design

# PLASTIC GEAR DESIGN WORKFLOW BY SABIC

Input

Output

**Working condition**
- Load (nominal, peak load)
- Speed
- Temperature

**Material selection**
- E-module / strength f(T)
- S-N curve*
- Wear & friction coefficient

**Design**
- Tooth height
- Tooth width
- Root and tip radius

**Temperature**
- Tooth root temperature
- Tooth flank temperature

Acceptable value

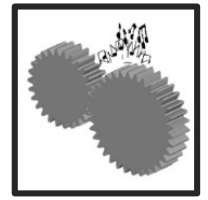
No

**Mechanical**
- Tooth root safety
- Bending safety
- Wear safety

Yes

Acceptable value

**Contact analysis**
- Wear simulation
- Transmission error



Yes

Finished

* Stress-Cycle curve

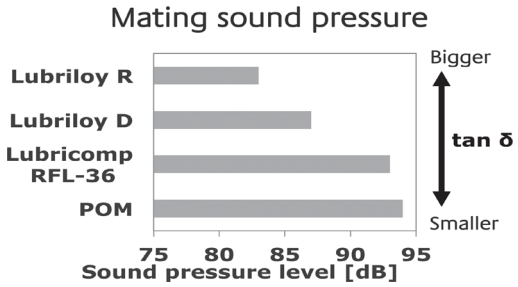
# SABIC LNP™ GEAR MATERIAL PORTFOLIO

## 1. Low noise

| Gear grades | Content | Characteristics |
|---|---|---|
| LUBRILOY™ D2000 | PC alloy | Dimensional stability, impact performance |
| LUBRICOMP™ KA000M | POM, AR, lub. | Low slip-stick, high accuracy |
| LUBRILOY R2000 | PA66 alloy | Low slip-stick, improved vibration damping |
| LUBRICOMP RAL23 | PA66, ARF, PTFE | Low wear pairings with PA-GF, low slip-stick performance |

### Testing method

Experimental meshing noise level measurement or loss factor measurement via dynamical mechanical analysis



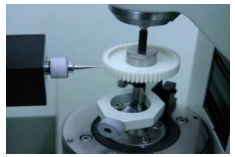

$$tan\delta = \frac{E''}{E'} = \frac{\alpha.\lambda}{\pi} *$$

$\lambda$ = the wave length
$\alpha$ = sound absorption
$tan\ \delta$ = loss factor

## 2. High accuracy

| Gear grades | Content | Characteristics |
|---|---|---|
| LUBRILOY D2000 | PC alloy | Dimensional stability, impact performance |
| LUBRICOMP KA000M | POM, AR, lub. | low slip-stick, high accuracy |
| LUBRICOMP DFL34 | PC, GF, PTFE | Dimensional stability, structural performance |
| LUBRICOMP EL003 | PEI, PTFE | Good dimensional stability as f(T) |

### Testing method



CNC tooth profile
Tti-120E

(Tokyo Technical Instruments, Inc.)

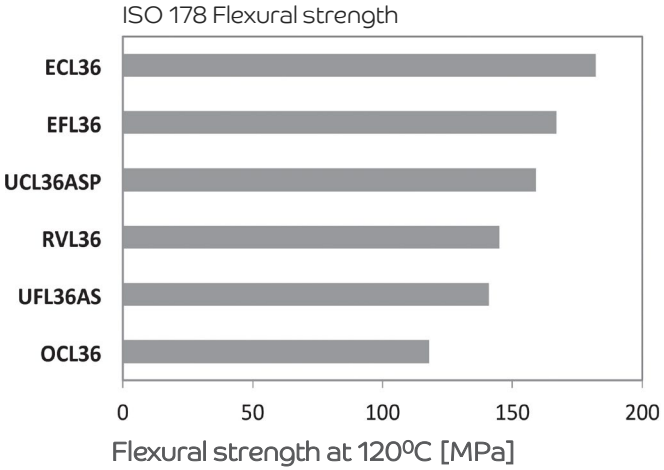
Rolling tester
TF-40NC

(Tokyo Technical Instruments, Inc.)

## 3. High heat / high torque

| Gear grades | Content | Characteristics |
|---|---|---|
| LUBRICOMP EFL36 | PEI, GF, PTFE | High strength, good dimensional stability as f(T) |
| LUBRICOMP OCL36 | PPS, CF, PTFE | Good plastic–plastic wear performance as f(T), high dimensional stability |
| LUBRICOMP UFL36AS | PPA, GF, PTFE | High strength, good plastic-plastic wear performance |
| VERTON™ RVL36 | PA66, LGF, PTFE | Fatigue strength, creep performance |

### Testing method

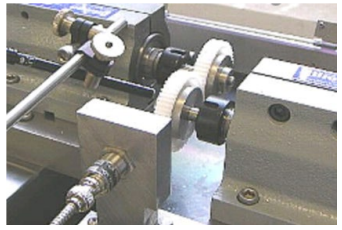


# SABIC LNP™ GEAR MATERIAL PORTFOLIO

## 4. Low wear

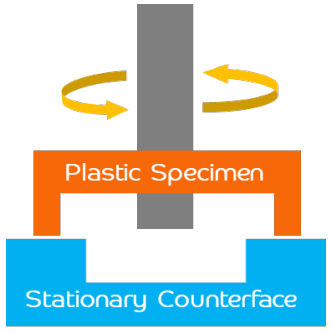
| Gear grades | Content | Characteristics |
|---|---|---|
| LUBRICOMP™ RFL36 | PA66, GF, PTFE | Structural gear benchmark grade, good fatigue performance |
| LUBRICOMP RAL23 | PA66, ARF, PTFE | Low wear pairings with PA-GF, low slip stick performance |
| LUBRICOMP OCL36 | PPS, CF, PTFE | Good plastic–plastic wear performance as f(T), high dimensional stability |
| LUBRICOMP UCL36ASP | PPA, CF, PTFE | high strength, good plastic–plastic wear performance as f(T) |

## Testing method



Module = 1
Z1=Z2 = 54
Width = 20

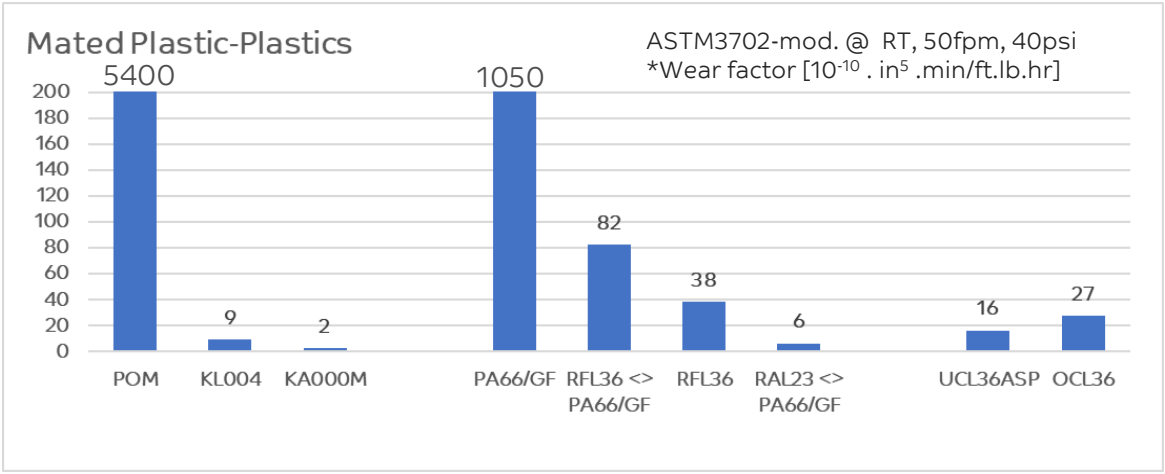
**Gear Wear Tester**
LRI-2GL, GH
(Lewis Research Inc.)

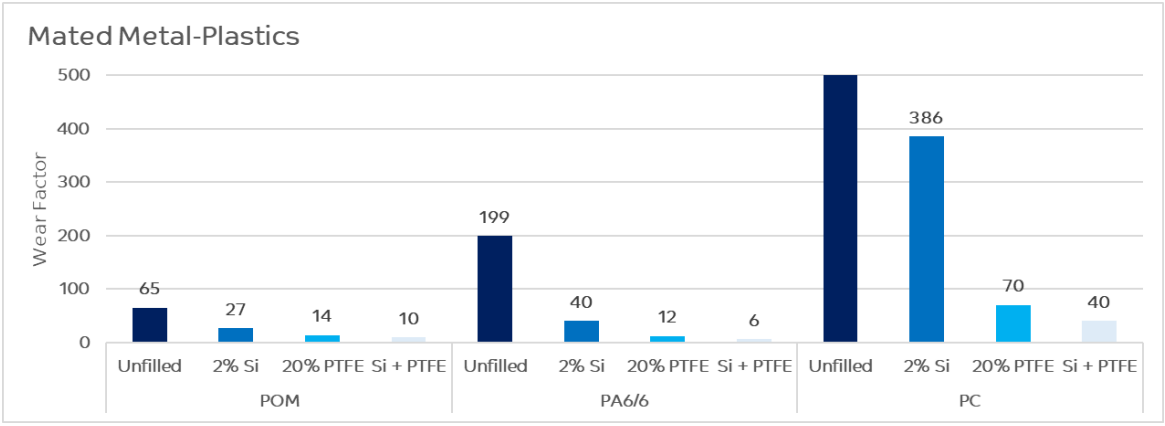



$$K_{(LNP)} = \frac{W}{PVT}$$

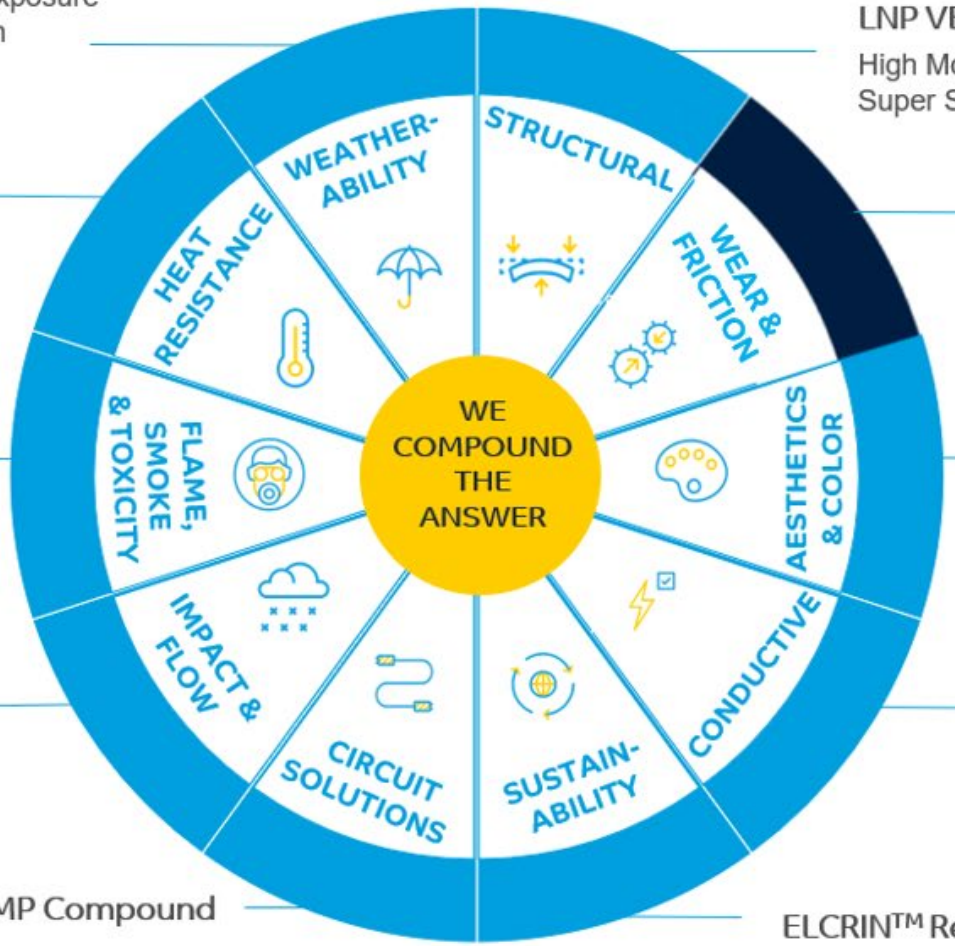
*K* = wear factor
W = volume wear
P = pressure
V = velocity
T = elapsed time

## Thrust Washer Tribometer



# LNP™ COMPOUNDS & COPOLYMER RESINS




**LNP™ SLX Resin**
Prolonged UV exposure
Paint Elimination

**LNP™ THERMOTUF™ Compound**
**LNP THERMOCOMP™ Compound**
**LNP VERTON™ Compound**
High Modulus Ductile
Super Structural

**LNP XHT Resin**
**LNP CXT Resin**
**LNP PPC Resin**
Excellent Processability
High Heat Resistant

**LNP LUBRICOMP™ Compound**
**LNP LUBRILOY™ Compound**
Wear Resistance
Friction Reduction

**LNP FST Resin**
**LNP CFR Resin**
FAR Compliant
Transparent FR

**LNP LUX-C & FX Resin**
**LNP COLORCOMP™ Compound**
Special colors
Transparency

**LNP EXL Resin**
**LNP HFD Resin**
Superior Flow
Low Temperature Impact

**LNP STAT-KON™ Compound**
**LNP STAT-LOY™ Compound**
**LNP FARADEX™ Compound**
**LNP KONDUIT™ Compound**
Thermal Dissipation
Electrostatic Dissipation

**LNP THERMOCOMP Compound**
Tunable Dielectrics
MID (Laser Direct Structuring)

**ELCRIN™ Resin and Compound**
Potential Reduced Energy & Carbon Footprint


THANK YOU

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