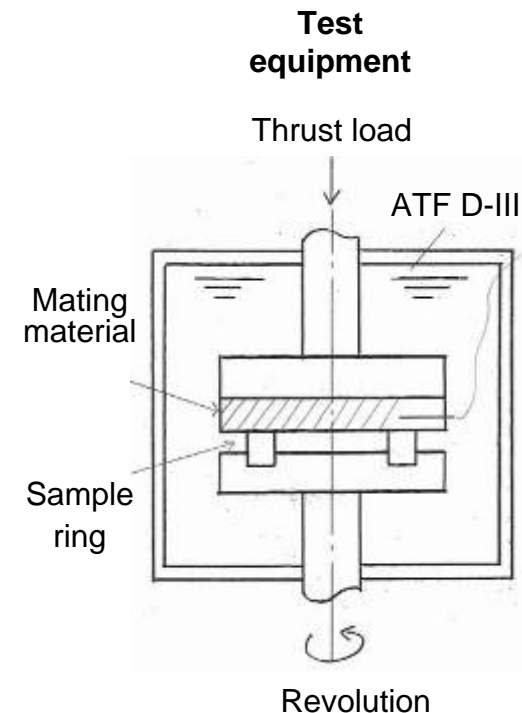
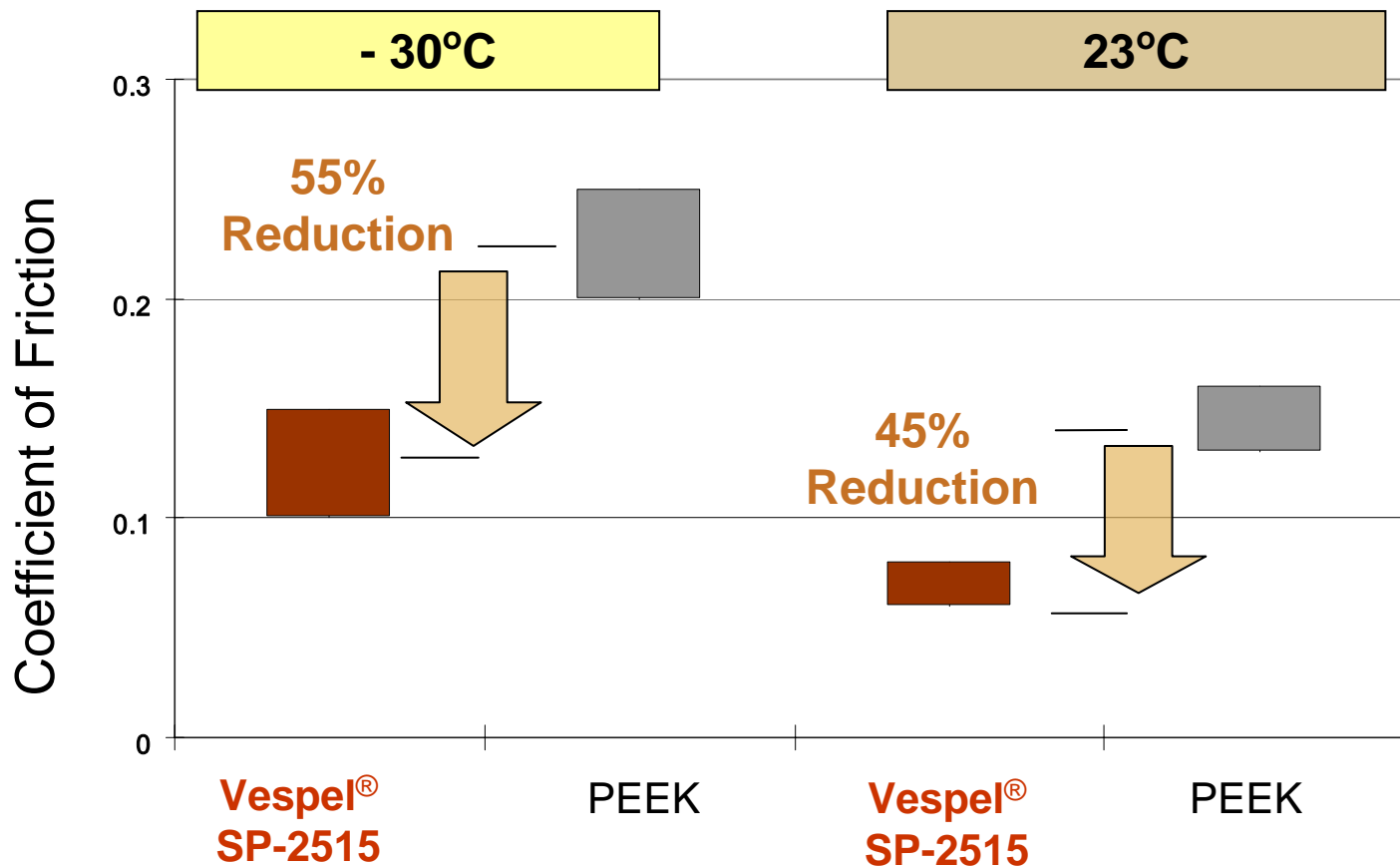


Low Friction = Reduced Torque Loss
= ***Improved Vehicle Efficiency***

Added Benefit from DuPont™ Vespel® SP-2515:

The low coefficient of friction of Vespel® SP-2515 can help designers improve component efficiency.



Test conditions

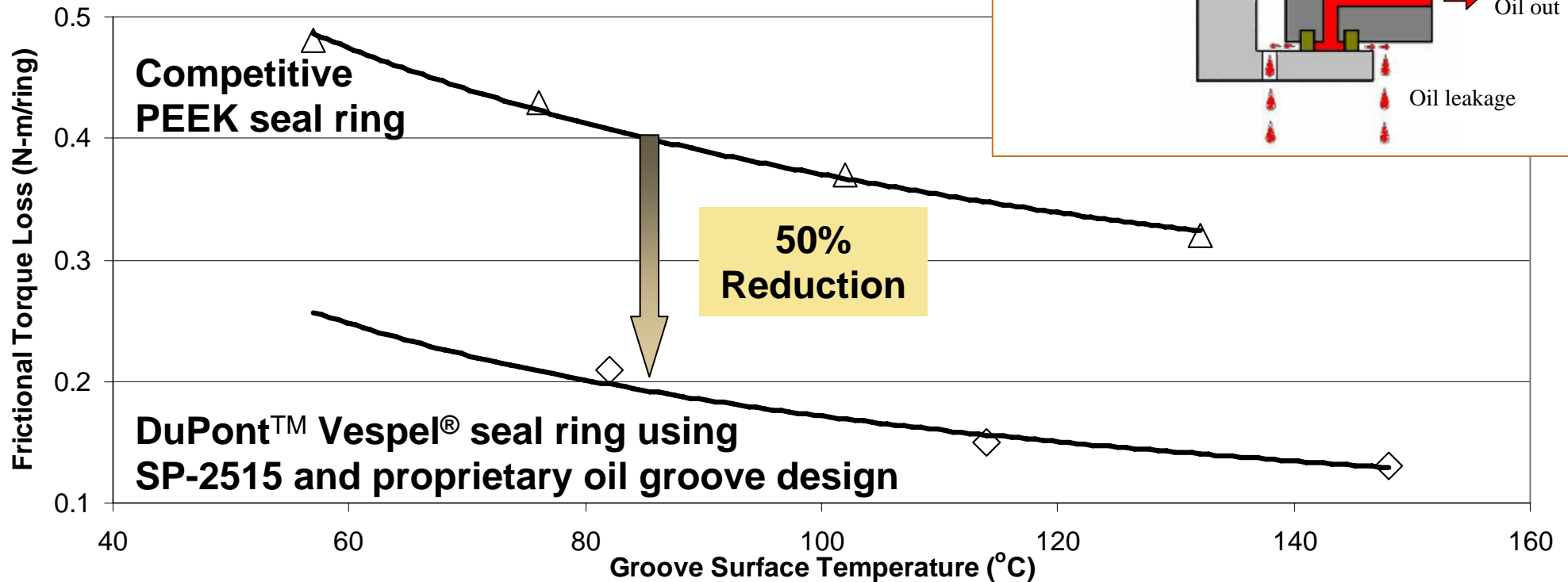
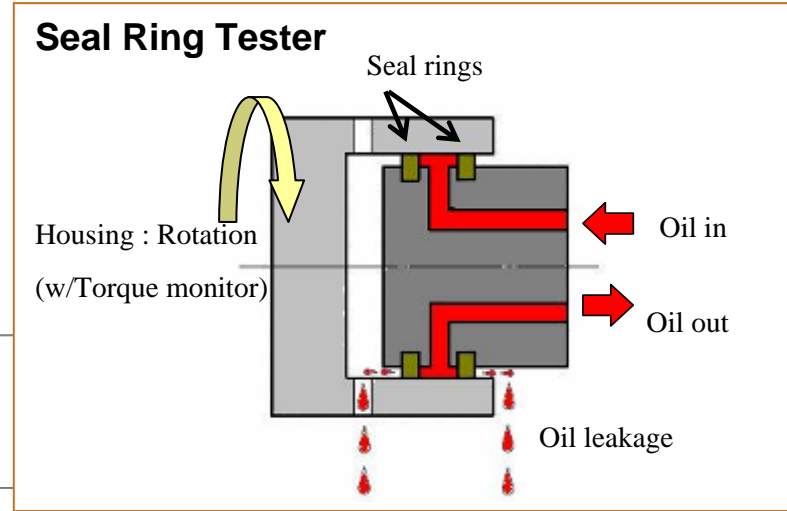
Thrust load: 0.4 MPa, Sliding speed: 1.67 m/sec Lubricant: ATF D-III

Mating material: cold rolled steel; roughness (R_{max}): 3.2μm; hardness: 105HV50

Low friction materials improve efficiency by reducing torque loss

(simulated transmission shaft and housing test, lubricated)

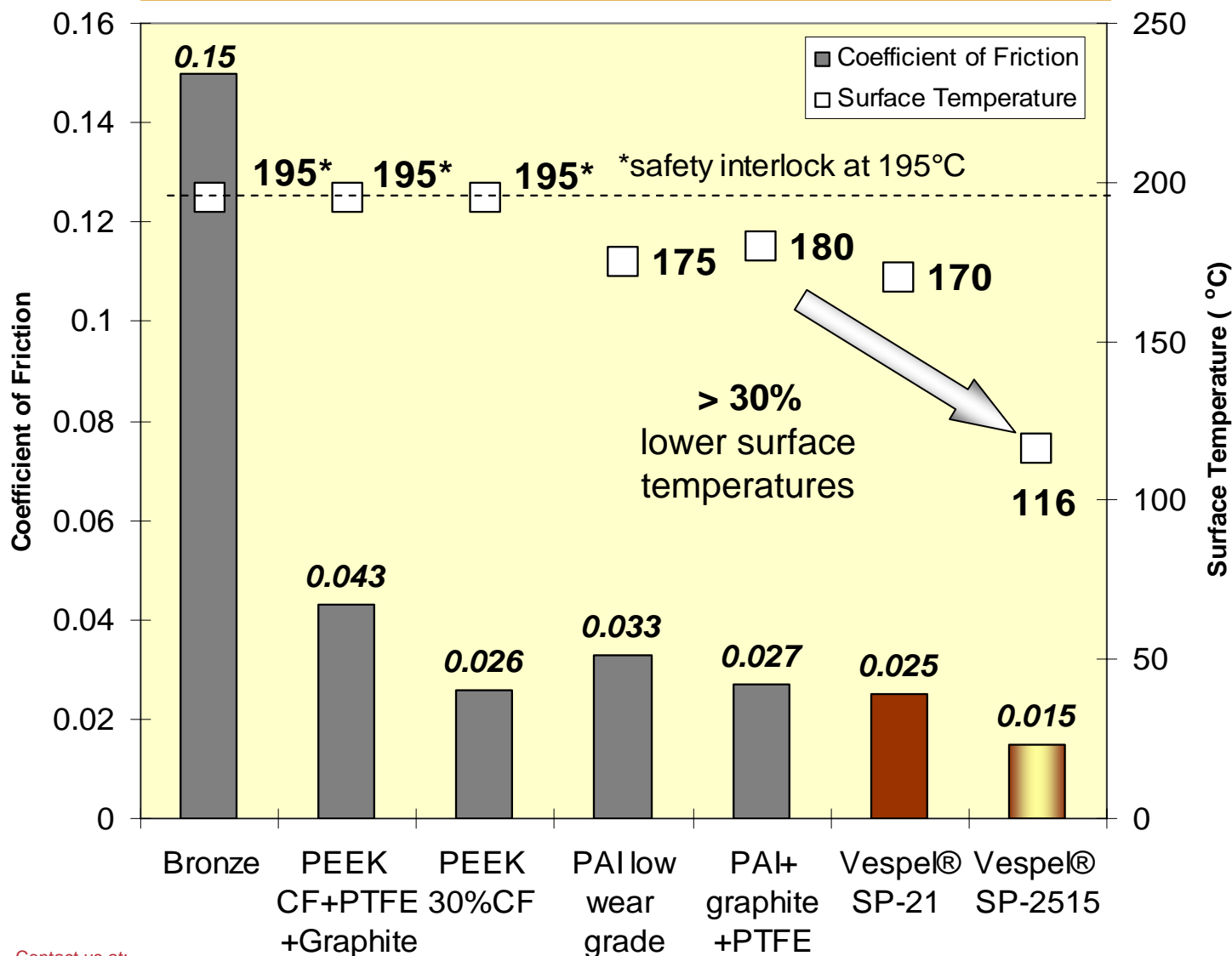
Seal rings made of DuPont™ Vespel® SP-2515 can reduce frictional torque loss by 50% compared with PEEK seal rings.



Test conditions: Oil Pressure: 1 MPa Speed: 6000 rpm Lubricant: ATF D-III
 Ring Dia.: 59 mm Mating material: carbon steel (AISI SAE:1045 or JIS: S45C)
 Housing & shaft roughness (Rmax): 3.2 µm Hardness: 250HV50

DuPont™ Vespel® SP-2515 can help remove heat from critical operating areas (bearing surfaces)

Thrust washer test results



- Vespel® SP-2515 has low coefficient of friction

- Vespel® SP-2515 has high thermal conductivity

✓ Allows cooler running bearing surfaces

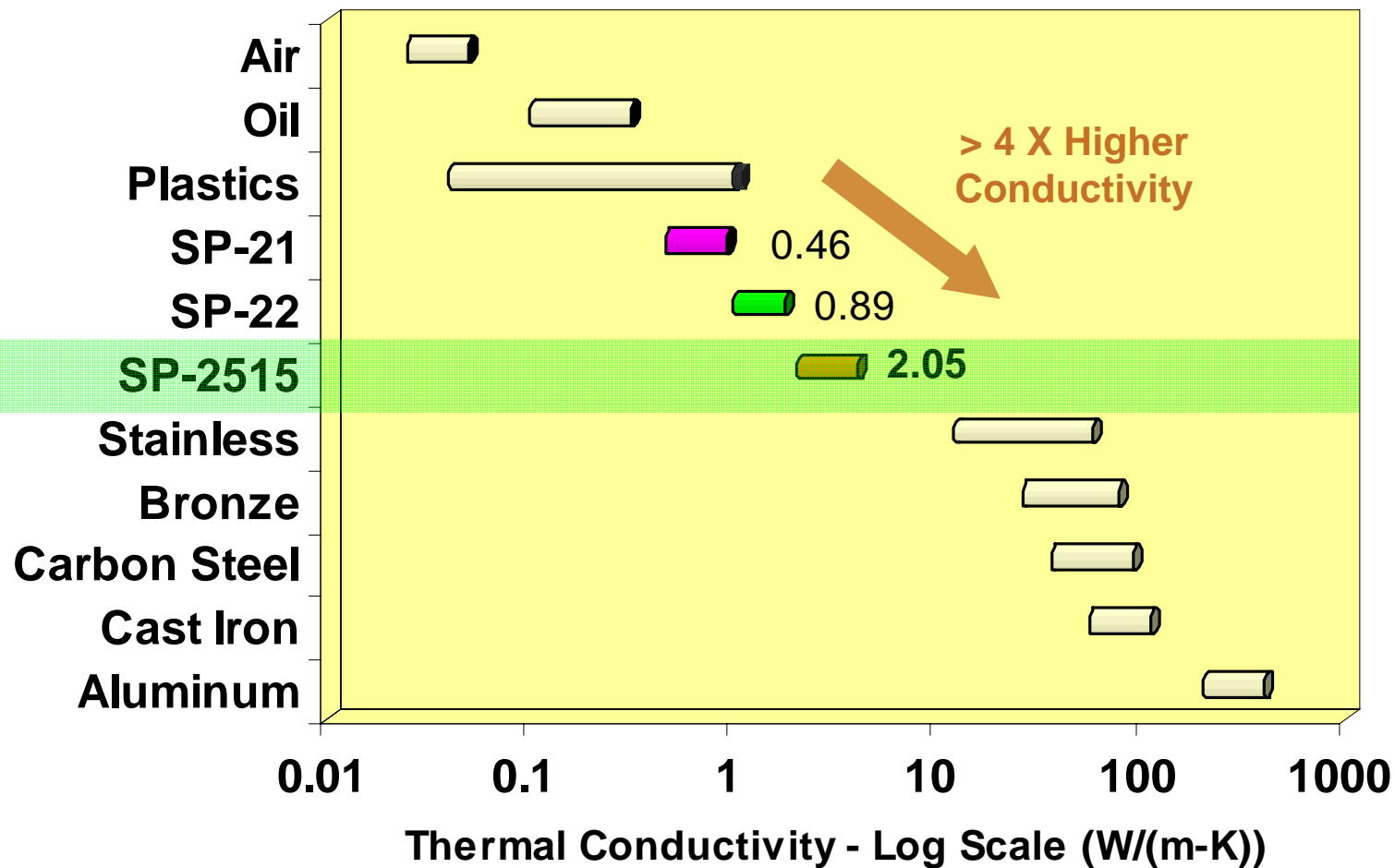
Mating Material: 4140 steel; 0.2Ra
 P: 2MPa V: 11.5 m/s Oil: ATFD-VI
 PV: 23 MPa·m/s Time: 60 min
 Oil start temp: 90°C at 500 cc/min



Getting the Heat Out

DuPont™ Vespel® SP-2515: High Thermal Conductivity

Vespel® SP-2515 offers high thermal conductivity which can help remove heat from critical bearing surfaces.



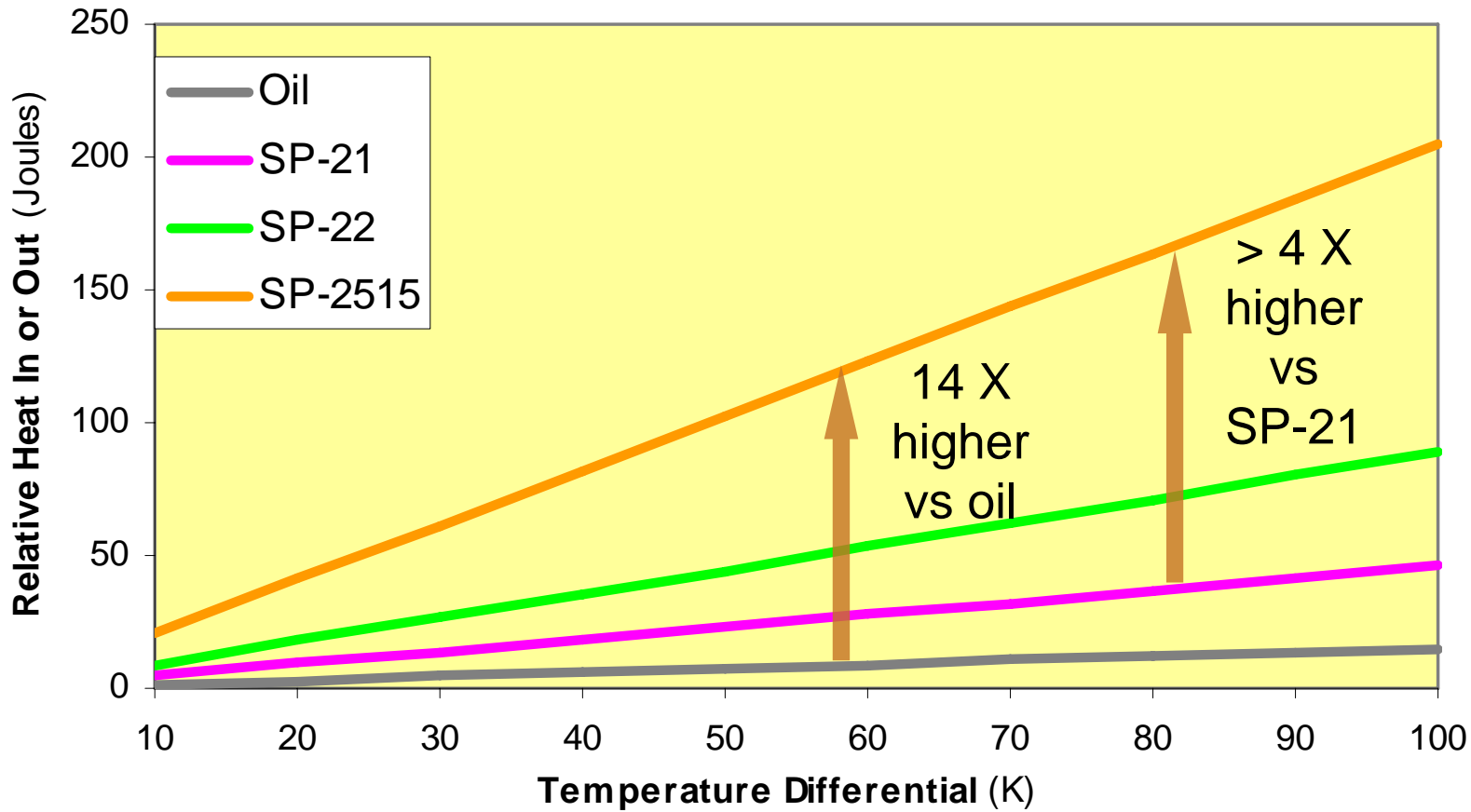
- Unique composition exhibits high thermal conductivity compared to other polymers

Allows for:

- ✓ Cooler running surfaces and parts
- ✓ Higher Pressure x Velocity (PV) limits.

DuPont™ Vespel® SP-2515 can help remove heat from critical operating areas (bearing surfaces)

Getting the Heat Out



- Vespel® SP-2515 has > 4X more heat conductivity than Vespel® SP-21

- ✓ May help provide cooler running bearing surfaces

Heat transfer (J) = $k(W/(m-K)) \times A(m^2) \times \Delta T(K) \times \Delta t(s) / X(m)$

Opportunities for Innovation

Lower friction materials can result in:

- **Improved component efficiency (improved mileage, lower emissions)**
- **Faster and more consistent response time & reduced actuation force**

Where else can you put low friction materials and DuPont™ Vespel® solutions to work for you?

Talk to us About ...	For ...
<p>Fuel efficiency / emissions</p> <p>Performance</p>	<p>Variable valve timing & lift</p> <p>EGR technologies</p> <p>Turbochargers</p>
<p>New propulsion (hybrids)</p>	<p>New transmission designs</p> <p>(6,7,8 speed; CVT; dual clutch; electric/hybrid)</p>
<p>Increasing use of electronic controls</p>	<p>Actuators, DC drives,</p> <p>stability control systems,</p> <p>electric pumps (fuel, oil, etc.)</p>

DuPont™ Vespel®



**Delivering big science, part by part.
Faster than ever before.....**