



MATERION

PRODUCT BRIEF



## SUPREMEX<sup>®</sup> COMPOSITES FOR LIGHTWEIGHT ROBUST HIGH PERFORMANCE PISTONS

Materion offers a range of high performance metal matrix composites (MMCs) in billet, forged, machined and coated forms. The refined microstructures from the Materion powder processing route offer a significant step change in piston performance. The advantages of using Materion SupremEX MMCs for pistons include:

### WEAR RESISTANCE

Higher hardness and wear resistance at elevated temperatures allow operation under extreme combustion conditions. This may eliminate the need for anodizing or other wear protection of wear surfaces such as ring grooves. The ability to position the top ring groove closer to the crown reduces crevice volume by >50%, thus mitigating knocking, reducing fuel consumption and hydrocarbon emissions.

### PIN BORE

Higher fatigue strength at 200°C enables positioning of the pin bore closer to the undercrown. This leads to increased connecting rod length and reduction in friction.

### THERMAL MATCHING

Lower coefficient of thermal expansion allows tighter piston-bore clearance at startup, resulting in reduced hydrocarbon emissions and fuel consumption.



Photo: GE Precision Engineering and Jaguar Land Rover

### FATIGUE STRENGTH

75% higher fatigue strength than AA2618 at 300°C allows reduced piston mass and/or higher combustion pressures. This provides the potential to obtain diesel combustion pressures in a gasoline engine.

### FRICTION

SupremEX MMC surfaces are naturally low in friction, reducing the need for skirt coatings or other modifications and additions.

## PROCESS ADVANTAGES

- Good machinability using proper tooling and conventional techniques
- Homogenous, stable microstructure and isotropy
- Near-net shape capabilities for improved machining yields

## PRODUCT FORMS

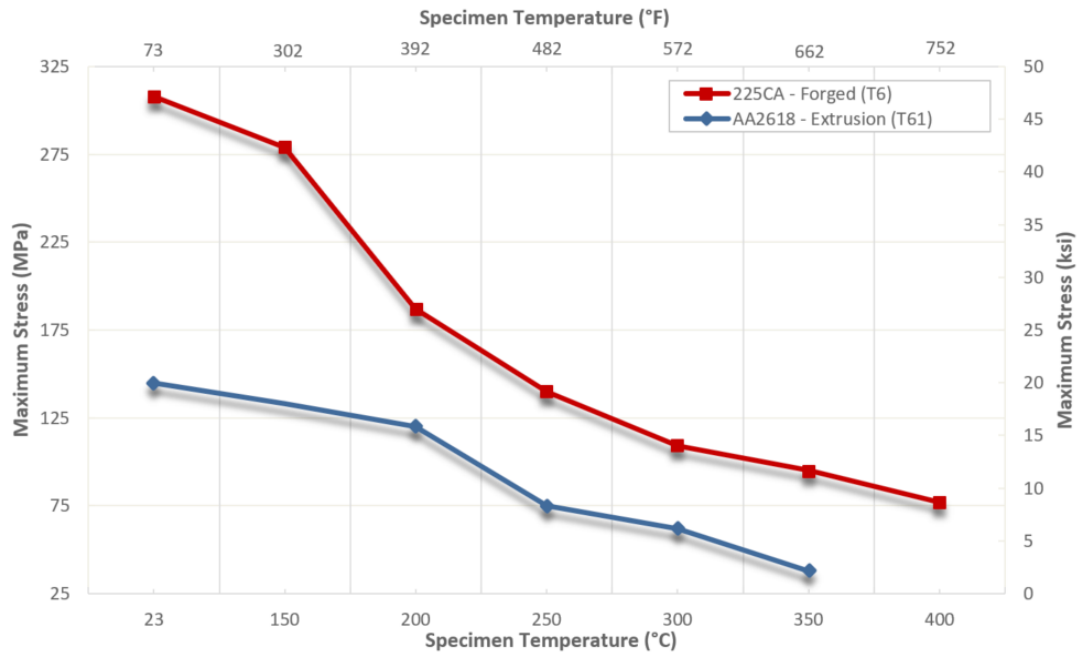
- Billet
- Near-net shape forgings
- Machined pistons

## TYPICAL MECHANICAL PROPERTIES – MMC AND Al-Si ALLOY CHOICES DEPENDING ON REQUIREMENTS AND REGULATIONS

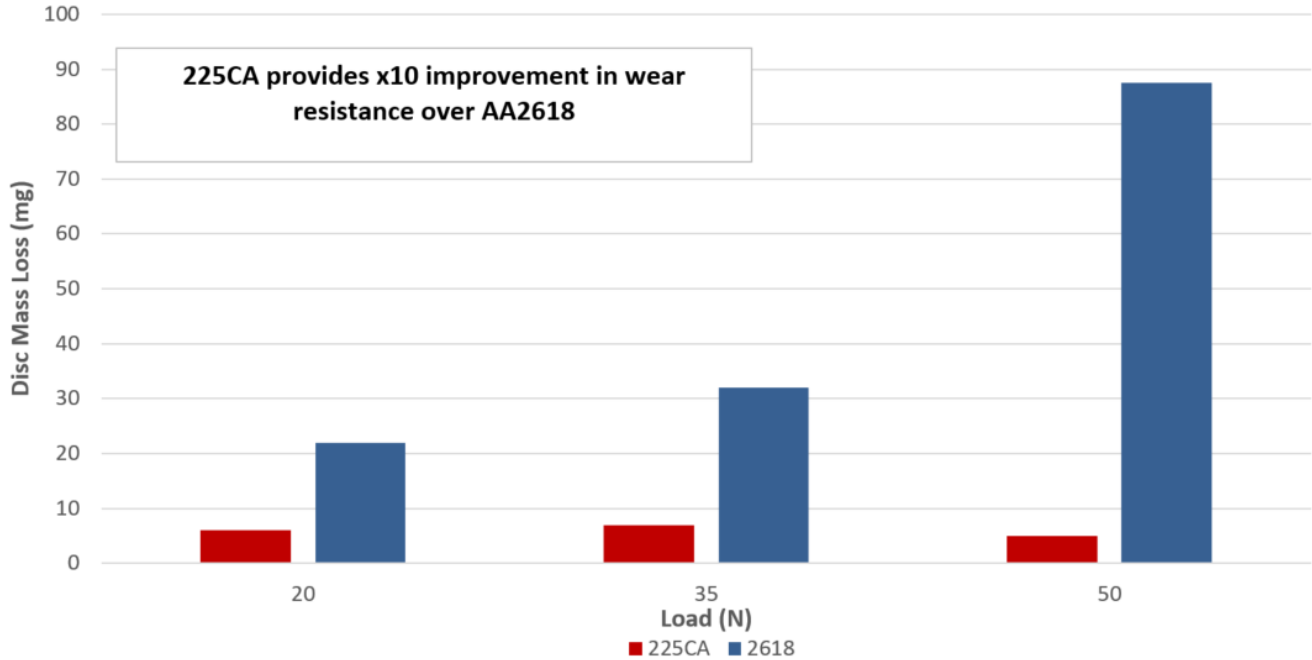
MATERIAL	SUPREMEX 225CA	AA2618
Product Form	Forged	Forged
Heat Treatment	T6	T61
R <sub>p0.2</sub> MPa (ksi)	435 (63)	370 (54)
R <sub>m</sub> MPa (ksi)	580 (84)	440 (64)
Elastic Modulus GPa (msi)	115 (16.7)	75 (10.4)
Elongation to Failure %	1.5	10
Density g/cm <sup>3</sup> (lb/in <sup>3</sup> )	2.88 (0.104)	2.75 (0.099)
Thermal Conductivity at 25°C W/m·K (BTU/hr·ft·°F)	156 (90)	146(84)
Thermal Expansion at 25°C ppm/°K (ppm/°F)	16 (9)	22 (12)

Data is for information purposes only, it does not constitute a guarantee. Data is typical of piston geometries.

## 225CA VERSUS AA2618 TEMPERATURE VERSUS FATIGUE STRESS (10M CYCLES)



**225CA VERSUS AA2618 PIN ON DISC WEAR RESISTANCE AGAINST AISI 4340 PIN (10,000 CYCLES)**



To learn more about **SupremEX<sup>®</sup>** metal matrix composites, visit [www.materion.com/supremex](http://www.materion.com/supremex). To speak with an engineer, call **1.216.692.3108**.



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