

## SUPREMEX® METAL MATRIX COMPOSITES

### FOR VALVE SPRING RETAINERS

Materion offers lightweight, high-strength and hard-wearing aluminum metal matrix composites for valve spring retainers. These performance retainers allow significant weight-saving to replace steel or titanium retainers and offer significant improvements in engine performance, especially at high engine speeds. The proprietary powder metallurgy manufacturing method provides an aluminum matrix reinforced with sub-micron silicon carbide particles to enhance the hardness and strength and allow for low-friction behavior when in contact with steel valve springs.

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### SupremEX Valve Spring Retainer Benefits

#### Reduced Mass

SupremEX 225XF retainers are one-third the weight of steel and two-thirds the weight of titanium parts. They reduce the valvetrain's reciprocating mass, meaning an opportunity exists to:

- Redesign the valve spring to achieve the same safety margin with respect to valve control and reduce contact force and friction.
- Increase engine RPM back to the original safety margin.
- Redesign the cam profile, taking advantage of the lower retainer and spring mass and potentially increasing valve acceleration with more area under the valve lift curve.

#### Fatigue Properties

High fatigue properties at room and elevated temperature allow for lightweight design and long life.

#### Wear Resistance

The combination of high strength, hardness and the ultra-fine ceramic reinforcement produces an excellent tribological match to steel valve springs. Minimal wear is seen on both 225XF retainers and steel valve spring during use.

#### Hardness and Strength

Both hardness and strength are maintained after extended time at elevated temperature, which enhances retainer life and reduces distortion during use.

#### Manufacturing Simplicity

SupremEX MMC provides a simple retainer solution. Unlike steel, titanium, or aluminium retainers SupremEX retainers do not require post-mill heat treatment or surface treatment, reducing processing time, cost and carbon footprint.

#### Reduced Contact Force

A lower contact force between follower and cam reduces engine friction and increases oil film thickness for reduced wear and longer life.

### SupremEX Composite Retainers in Action: Sprint Car Racing

Sprint car driver Steve Rando replaced the steel retainers in his 305 Chevy V8 car with SupremEX 225XF material and after nearly 40 races, he is still seeing many benefits, including:

40% Reduction in retainer mass vs. steel

An increase in max RPMs by 400

Minimal wear



# Product Brief continued

Material	225XF	Ti 6Al-4V	Steel - 4140
Density g/cm <sup>3</sup> (lb/in <sup>3</sup> )	2.88 (0.104)	4.43 (0.160)	7.85 (0.284)
R <sub>p0.2</sub> MPa (ksi)	540 (78.3)	945 (137.1)	965 (140)
R <sub>m</sub> MPa (ksi)	650 (94.3)	1103 (160)	1140 (165.3)
Elastic Modulus GPa (msi)	115 (16.7)	112 (16.2)	200 (29)
Specific Modulus GPa/g/cm <sup>3</sup>	39.9	25.3	25.5
Elongation to Failure (%)	2.5	8	18
Thermal Conductivity @ 25°C W/m <sup>2</sup> K (BTU/hr.ft. <sup>2</sup> .°F)	150 (87)	22 (12.8)	42.6 (24.7)
Thermal Expansion @ 25°C ppm/°C (ppm/°F)	15.5 (8.6)	9 (5)	12.2 (6.7)
Vickers Hardness Hv10Kg	220	350	338
Coefficient of Friction dynamic vs. 4340 steel	0.11	0.39	-

Information is for comparative purposes only and information provided is based on general industry information and material properties can be different based on minimum, typical or maximum properties along with specific heat treatment conditions & product forms. CWQ stands for cold water quench. Data is for information purposes only; it does not constitute a guarantee.

## SupremEX MMC Retainer Availability

Have your retainer manufacturer contact Materion for retainer materials and technical assistance. Alternatively, Materion offers fully heat treated and machined retainers to drawings or to customer designs.



SupremEX valve spring retainers (right) are redesigned to provide the same strength and stiffness as steel (left) with significant mass reduction.

## SupremEX® Composite Retainers in Action: Motocross

The REVO Husqvarna MX2 team utilized SupremEX 225XF valve spring retainers in their team's bikes in 2019. Not only did the team take the title of 2019 British MX2 Champions, but the new valve springs improved their bikes with:

3.6g Reduction in retainer mass vs. steel

An increase in max RPMs by 800



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