

MetaCORE

Lightweight, impact absorbing advanced metamaterial

Technical datasheet



Description

Our flagship light-weight structural material is engineered with the properties of an ideal impact absorber and can be customized with application-specific crush strength. MetaCORE is produced in flat sheets, blocks, sandwich panels, or can be pre-formed to a smooth curved surface.

Table 1: Characteristics of MetaCORE with corresponding advantages

Characteristic	→	Advantage
High Crush Force Efficiency	→	Mitigates sudden deceleration
High Specific Energy Absorption	→	Lightweight protection
Pro-Isotropy	→	Multi-directional performance
Low Mass Density (Lightweight)	→	Total system weight reduction
Corrosion Resistance	→	Increased durability
Cost Savings	→	Widely available raw materials
Customer-Preferred Manufacturing Methods	→	On-demand customization

Geometric Motifs

Multi-objective optimization rarely produces a single solution. The MetaCORE product line was conceived as a lightweight impact-absorbing structural material and the geometric motifs below all satisfy these criteria, but in slightly different ways. Variations in geometry allow us to access a different range of material properties.

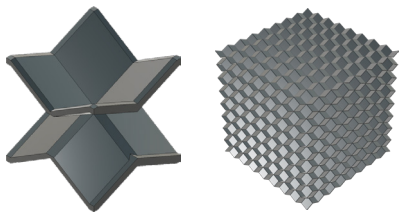


Fig. 1: MetaCORE [EB] motif as single unit cell and tessellation (right).

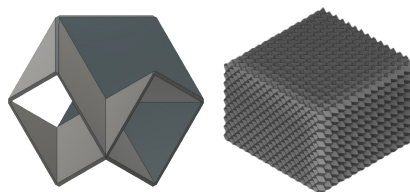


Fig. 2: MetaCORE [MO] motif as single unit cell and tessellation (right).

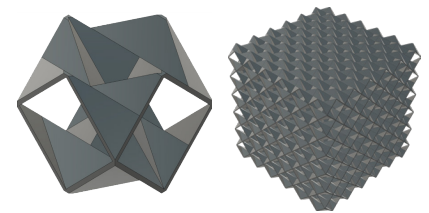
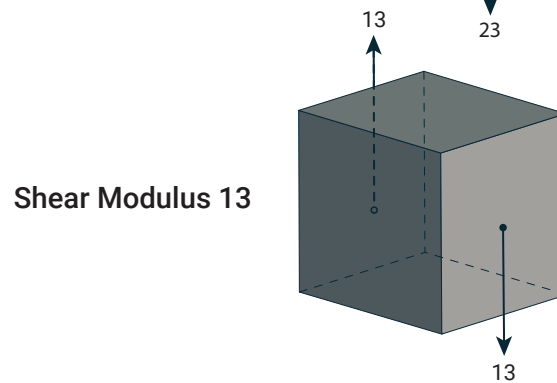
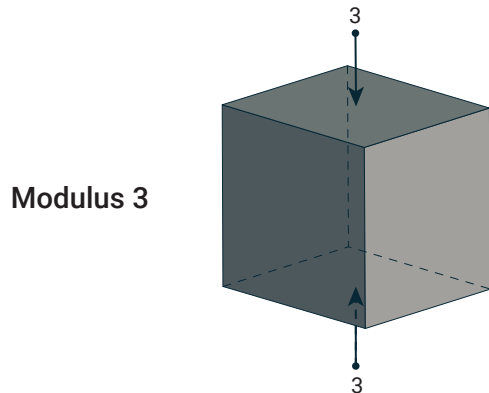
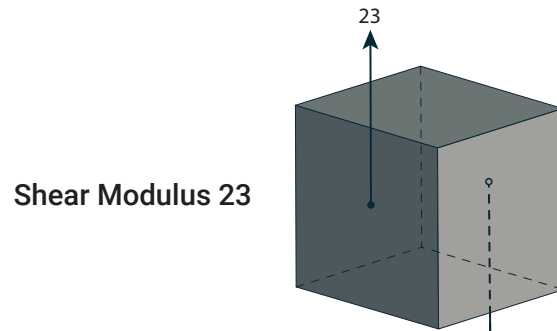
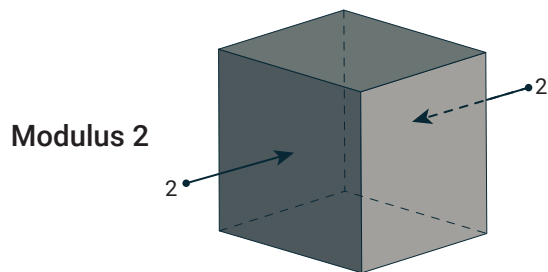
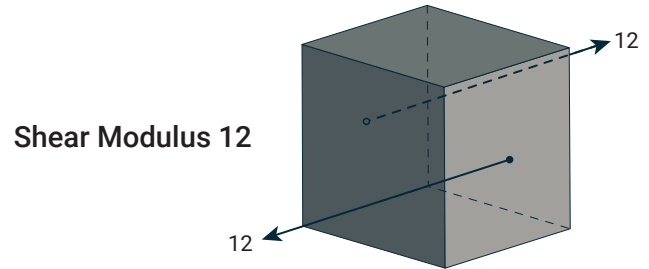
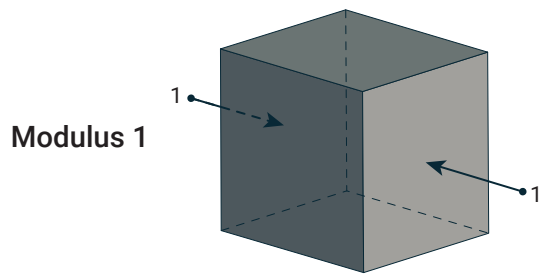
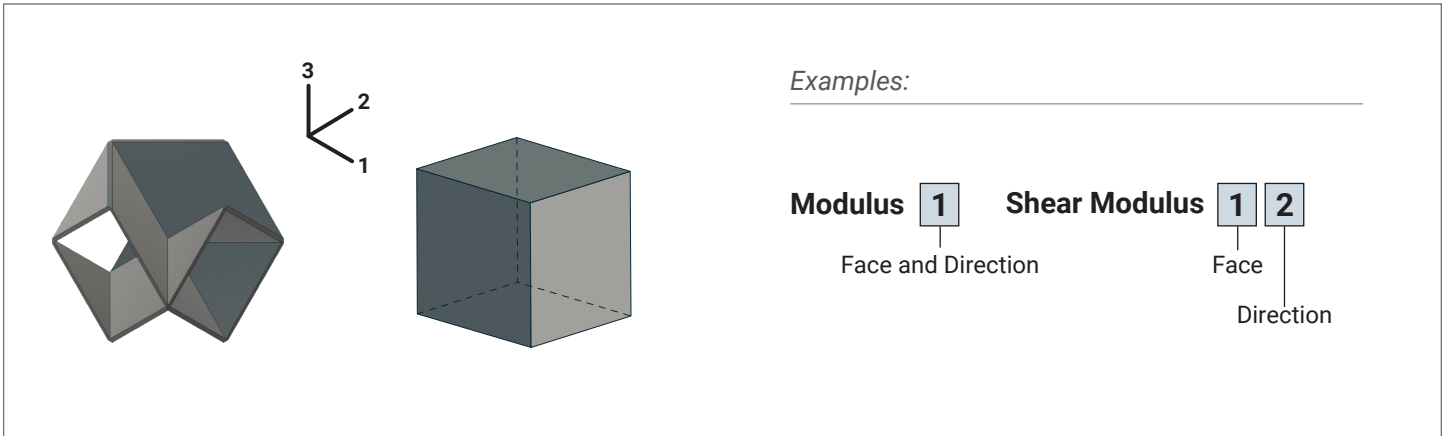


Fig. 3: MetaCORE [WB] motif as single unit cell and tessellation (right).

Definitions of Moduli Coordinate System



Note: By symmetry, Shear Modulus 12 = Shear Modulus 21; Shear Modulus 23 = Shear Modulus 32; and Shear Modulus 13 = Shear Modulus 31.

Specification of MetaCORE metamaterials

Product - Motif - Material - Cell Length - Relative Density

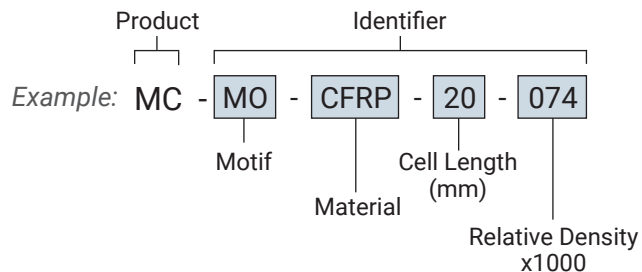


Table 2: MetaCORE Density, Typical Modulus, Typical Shear Modulus, and Typical Yield Strength

Metamaterial	Base Material	Density		Typical Modulus 1		Typical Modulus 2		Typical Modulus 3		Typical Shear Modulus 12		Typical Shear Modulus 23		Typical Shear Modulus 13		Typical Yield Strength	
		pcf	kg/m ³	kpsi	MPa	kpsi	MPa	kpsi	MPa	kpsi	MPa	kpsi	MPa	kpsi	MPa	kpsi	MPa
General range	CFRP	3-20	50 - 300	0.8 - 10k	1 - 100	1 - 5	1 - 100	1 - 15	1 - 100	0.15 - 15	1 - 100	0.15 - 15	1 - 100	0.15 - 15	1 - 100	0.1 - 0.7	2 - 5
General range	Aluminum	6-30	100 - 500	2 - 250	100 - 2,000	24 - 110	100 - 1,000	30 - 300	100 - 2000	40 - 300	300 - 3000	50 - 250	300 - 2000	50 - 450	300 - 3000	1 - 4	10 - 30
EB-CFRP-20-074	CFRP	6	95	0.8	6	1	7	1.4	10	2	13	2	14	7.5	52	0.3	2
EB-AL-20-074	Aluminum	13	200	20	150	24	175	36	250	47	325	50	350	190	1300	1.5	10
MO-CFRP-11-173	CFRP	14	221	3	21	4	30	2.9	20	12	84	10	67	19	130	0.6	4.5
MO-AL-11-173	Aluminum	29	470	76	525	110	750	73	500	300	2100	240	1675	450	3250	3.5	24
WB-CFRP-26-100	CFRP	8	130	10	70	3.5	25	11	76	2	12	2	14	2	14	0.4	2.5
WB-AL-26-100	Aluminum	17	270	250	1750	90	625	275	1900	40	300	50	350	50	350	2	14

Table 3: MetaCORE Typical Specific Energy Absorption (SEA) and Typical Poisson's Ratio

Metamaterial	Base Material	Typical SEA Min.	Typical SEA Max.	Typical Poisson's Ratio 12	Typical Poisson's Ratio 23	Typical Poisson's Ratio 13
		kJ/kg	kJ/kg	no unit	no unit	no unit
General range	CFRP					
General range	Aluminum	2 - 20	20 - 60	-1.5 - 4	-1.5 - 4	-1.5 - 4
EB-CFRP-20-074	CFRP			0.38	-0.04	0.64
EB-AL-20-074	Aluminum	18	51	0.38	-0.04	0.64
MO-CFRP-11-173	CFRP			0.68	-0.9	0.95
MO-AL-11-173	Aluminum	3	20	0.68	-0.9	0.95
WB-CFRP-26-100	CFRP			-0.45	0.64	0.91
WB-AL-26-100	Aluminum	23	56	-0.45	0.64	0.91

CFRP = Carbon Fiber Reinforced Plastic

Aluminum = 6061 aluminum alloy



The information herein is based on technical data Multiscale Systems, Inc. ("Multiscale Systems") believes to be accurate at time of issue. Multiscale Systems reserves the right to update, revise, or modify such information at any time. This data is intended for use by persons with technical skill, and is not a substitute for your own testing of suitability of our products for your particular purpose. Multiscale Systems makes no warranties regarding these materials or information, either express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. Nothing herein is to be taken as a license to operate or a recommendation to infringe on patents.

+1-855-955-7900
info@multiscalesystems.com

49 Canterbury Street, Suite 500
Worcester, MA 01610

multiscalesystems.com

© 2020 Multiscale Systems, Inc.