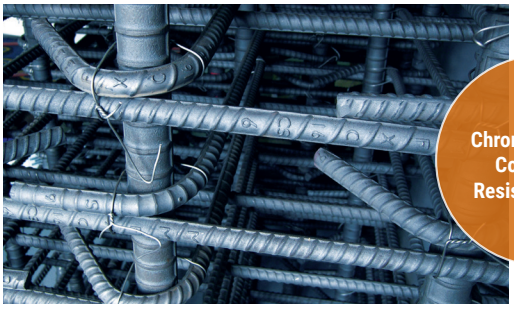
CHROMX®

Product Comparison

CHROMX® / GFRP / BASALT REBAR

ENGINEERING BULLETIN #4



ChromX® vs.

Glass Fiber Reinforced Polymer (GFRP) vs. Basalt Rebar

DESIGN ACCORDING TO ACI 318-19 CODE

	CHROMX®	GFRP	BASALT
Material Specifications	ASTM A1035	ASTM D7205	
Tensile Strength	150 ksi #3 through #18	Guaranteed tensile strength (1) #2 through #10 Dependent on size 80 – 130 ksi #11 through #13 (2) 60 – 70 ksi	116 – 150 ksi Variable dependent on Size
Yield Strength	100 ksi	No yield strength Bar fracture at ultimate	No yield strength Bar fracture at ultimate
Modulus of Elasticity	29 x 10^6 psi	6.7 x 10^6 psi	6.7 x 10^6 psi
Ultimate Strain %	> 7%	0.9% – 1.9%	2.30 % - 3.0 %
Bar Quantity required for same design load, deflection and Cracking	25%	100%	100%
Shear Strength Design	80 ksi	22 ksi	N/A
Standard Stock Length	#3 through #18 available in 40 ft. and 60 ft. Special length up to 72 ft.	#2 through #13	#2 through #8
Fabrication	Same as carbon steel	• Must be hand-made at factory with large bend diameters. • Field bending not permitted. • 50% strength of the straight bar.	• Must be hand-made at factory with large bend diameters. • Field bending not permitted. • 50% strength of the straight Bar.
Handling and Storage	Same as regular steel	• Placements similar to epoxy coated bars. • Floating during vibration require securing GFRP to formwork.	• Placements similar to epoxy coated bars. • Floating during vibration require securing GFRP to Formwork.
Durability	Corrosion resistance up to 4 times of black steel.	• 80% of the straight length in alkaline environment without load. • Major reduction when under sustained load.	No data available
Couplers and Terminators	Available in all sizes	Not available	Not available
Fire / Elevated Temperatures	Similar to black steel	Major problems	Major problems
Recycling	Similar to black steel	Not recyclable	Not recyclable

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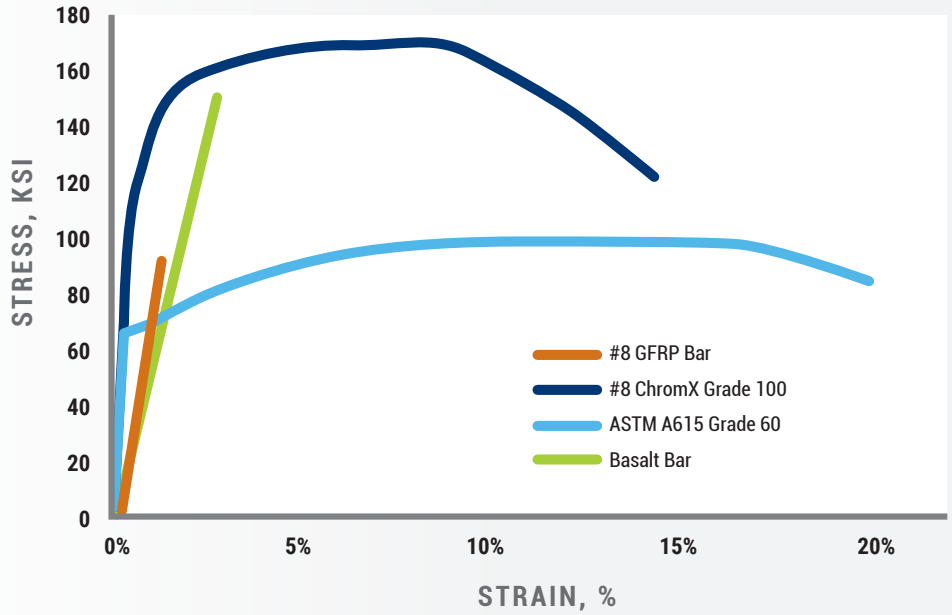
Stress vs. Strain Plot of GFRP Bar Basalt Bar, Black Steel Grade 60 and ChromX® Steel Grade 100



ChromX® Grade 100 Design Examples as per ACI 439-6R-19 compared to GFRP Design Examples as per ACI 440.1R-15

NOTES		CHROMX® GRADE 100	GFRP
6.1 PCA Notes – Design Flexural Capacity	4000 psi concrete beam section reinforced with 3 ee#8 bars	114.2 ft kip	70.5 ft kip
Flexural capacity of concrete beam reinforced with equal area of reinforcement of ChromX® yields 60% more capacity of Beam reinforced with GFRP reinforcement (114.2 vs 70.5 ft kip).			
6.1 PCA Notes with 2 bars instead of 3	4000 psi concrete beam section reinforced with 2 #8 bars	98.5 ft kip	
ChromX® reinforced beams with 33% less reinforcement (2#8 vs 3#8) yields 40% more flexural capacity than GFRP reinforcement (98.5 vs 70.5 ft kip).			
7.1 PCA Notes – Tension Reinforcement only	4000 psi concrete section to resist Moment Capacity of 123.2 ft kip	ChromX® = 1.1 in2	AFRP = 3.11 in2
GFRP reinforced beams require three times the reinforcement area of the ChromX® reinforced beams to resist the same moment capacity (3.11 in2 vs 1.1 in2).			