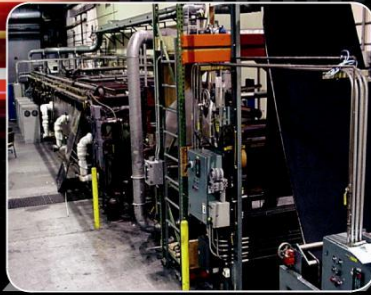




AvCarb® Carbon Fabrics

Moving Energy with Carbon



AvCarb Carbon Fabrics

AvCarb has been producing high quality polyacrylonitrile (PAN) carbon fiber products since 1978. Drawing on unique carbon fabric processing technology, AvCarb carbon fabrics are designed to meet the demanding requirements of gas transport, motion control, electrical and elevated temperature applications.

The first step in the process of producing high performance carbon fabrics is the conversion of PAN to a highly thermoset ladder polymer called Avox™ Oxidized PAN. The Avox fiber, the basic building block for AvCarb carbon fabrics, is then converted into long worsted staple fiber yarns that are woven into a construction designed for the application.

To meet the demanding needs of the many potential applications, the Avox fabrics are first carbonized in Ballard's proprietary AccuCarb™ continuous carbonization process. At this stage, the fabrics have

an 88-95% carbon content and are called "HC" grade fabrics. Vacuum batch baking at extremely high temperature results in our "HCB" grade fabric, a 99+% carbon fabric with graphitic properties.

Produced in long, continuous rolls, AvCarb carbon fabrics are easy to store, handle and use. Their uniform properties over the length and width of each roll, and from roll to roll, not only assure product consistency but also lend themselves to easy integration with continuous manufacturing processes.

All AvCarb carbon fabrics are manufactured using processes and quality systems registered by Det Norske Veritas, a major international certifying body, to be in conformance with ISO 9001 and ISO/TS-16949. As a Tier 1 supplier of critical drive train components to the automotive industry, AvCarb has the ability to provide quality products, on time, with added value.

Representative Avcarb Carbon Fabric Applications

Fabric Style	Application
1071 HCB	Gas Diffusion Layer (PEM Fuel Cells), Other Electrochemical Applications
1209 HC	Ablative Insulation (Solid Fuel Rocket Motors)
1698 HCB	Carbon-Carbon Composite Reinforcement, Tooling, Composites
1209 HCB	Carbon-Carbon Composite Reinforcement, Tooling, Composites
1243 HCB	Carbon-Carbon Composite Reinforcement, Tooling, Composites



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Typical Avcarb Fabric Styles***/Grades							
	1071	1243	7575	1698	1209	1185	1186
Grade	HCB*	HCB*	HCB*	HCB*	HCB*	HCB*	HCB*
Weave Construction	Plain	Plain	Plain	8 Harness Stain	Plain	Plain	2x2 Basket
Weave Count							
Warp - per cm (inch)	19.3 (49)	11.8 (30)	9.1 (23)	15.0 (38)	9.8 (25)	9.1 (23)	8.3 (21)
Fill - per cm (inch)	18.5 (47)	11 (28)	7.9 (20)	15.0 (38)	7.5 (19)	6.7 (17)	8.3 (21)
Basis Weight g/m (oz/yd)	132 (3.9)	220 (6.5)	254 (7.5)	295 (8.7)	295 (8.7)	335 (9.9)	518 (15.3)
Thickness @ 1 PSI microns (mils)	356 (14.0)	700 (27.6)	762 (30)	889 (35)	645 (25.4)	876 (34.5)**	1321 (52)
Typical Width cm (inches)	117 (46)	117 (46)	117 (46)	117 (46)	117 (46)	117 (46)	117 (46)

* Also available in HC grade (88 - 95% carbon)
 ** Thickness at 7.3 psi
 *** Other fabric styles may be available on request

Yarn Filament Properties		
Grade	HC	HCB
Diameter microns (mils)	7.5	7.5
Cross Section	Round	Round
Density g/cm ³	1.72-1.75	1.75-1.77
Surface Area g/cm ²		0.62
Tensile Strength kN/cm ² (ksi)	211 (306)	192.5 (279)
% Elongation @ Break	1.00	0.72
Electrical Resistivity ohm-cm	Controllable	1.1 x 10 ⁻³
Thermal Oxidative Stability wt loss/hr@500 C in air	Oxidizes	<1.0
% Carbon Content	88-94	99.5

Typical Composites Data			
Grade	1071HCB	1243HCB	1698HCB
Flexural Strength ksi (MPa)	50 (345)	38 (262)	48 (331)
Flexural Modulus msi (Gpa)	7.5 (51.7)	6.0 (41.4)	8.9 (61.4)
Interlaminar Shear ksi (MPa)	5.0 (34.5)	4.5 (31)	4.5 (31)
Density g/cm ³	1.5	1.56	1.56
Fiber Volume (%)	50.0	55.0	55.0
Cured Ply Thickness microns (mils)	102 (4.0)	229 (9.0)	279 (11.0)

