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TRUSTED INNOVATION

COMPOSITES · 合成材料

BOYD - WORLDWIDE ENGINEERED MATERIALS - SINCE 1928

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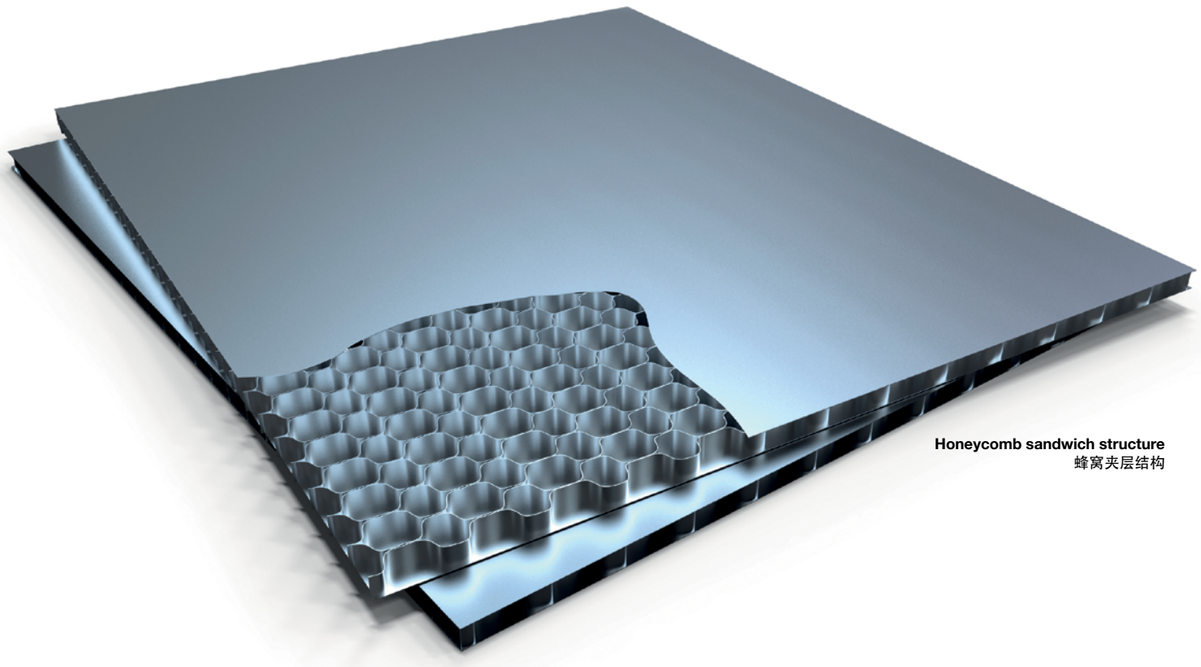
BOYD NIVELLES

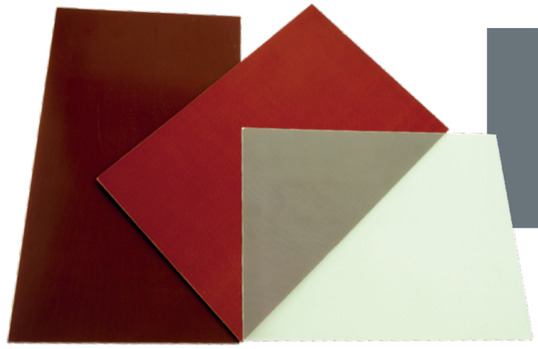
Located in the heart of Europe, close to Brussels, **BOYD** is a Belgian company that has been designing, manufacturing and marketing high-tech parts since 1946. Recognised as a leader on the European market in the **elastomers**, **cellular rubbers** and **expanded plastics** sector, in recent years **BOYD** has expanded its range of materials to include **composites** and **thermoplastics**. Today, this expansion of the range allows **BOYD** to cover all **polymer-based materials** (elastomers, cellular rubbers and expanded plastics, and thermoplastics) as well as **composite materials** with thermosetting and thermoplastic matrices. Clearly, **BOYD** wants to offer its customers as large a portfolio of high-tech products as possible, covering a range of applications that is as diverse as possible.

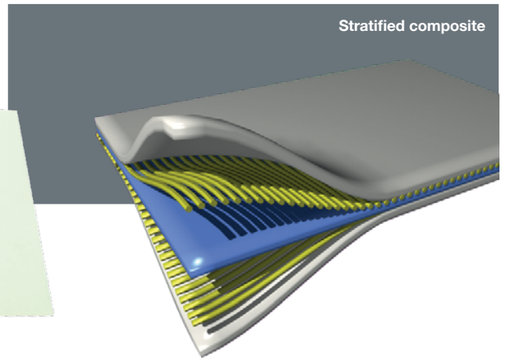
BOYD NIVELLES 公司

BOYD Nivelles 地处欧洲核心，毗邻布鲁塞尔，是一家专业从事高科技部件设计、生产及销售的比利时公司， 其悠久的历史可一直追溯至 1946 年。作为弹性材料、海绵橡胶及泡沫塑料行业的欧洲市场领军企业，**BOYD** 在近些年内还大大拓宽了自身的合成及热塑材料系列产品。如今，这一系列拓展更令 **BOYD** 的产品涵盖了所有以聚合物为基础的材料 （弹性材料、海绵橡胶、泡沫塑料及热塑材料），并一举将全部热固及热塑性基质合成材料纳入麾下。很显然，**BOYD** 的愿景就是为客户提供覆盖多样化应用范围的全方位高科技产品系列。



Honeycomb sandwich structure
蜂窝夹层结构





DEFINITION OF COMPOSITE MATERIALS

A composite material is an assembly of at least two non-mixable components that nevertheless have a strong capacity for mutual adhesion. The new material thus created possesses properties that are superior to those of each of its components. A composite material typically consists of the following three components:

- **A framework known as a reinforcement** (generally based on short, long or continuous fibres) that provides the mechanical strength (resistance and rigidity) of the composite.
- **A binder known as a matrix** (generally a thermoplastic or a thermoset-based material) that provides the cohesion of the structure, transmits stresses to the reinforcement and protects the reinforcement from the environment.
- **Additives and charges** are generally added to improve certain properties of the material, such as UV resistance, conductivity, fire resistance, etc.

合成材料的定义

合成材料即指那些至少由两种互不混溶但又具备相互强力粘附能力的组分所构成的混合材料。如此构成的新材料拥有着比其中任何一种组分都要更为卓越的特性。典型的合成材料主要由以下三种组分构成：

- 被称之为加强体的构架（通常以长纤维、短纤维或连续纤维作为基础），其可为合成材料的机械性能（强度及刚性）提供保证。
- 被称之为基质的粘合剂（通常为塑料材质），其可在结构的黏结力、加强体的应力传输及保护加强体免受环境影响方面提供保证。
- 添加剂及填料，为了改善材料的某些性能（如抗 UV 性、传导性、耐火性等），人们通常会在合成材料中加入特定的添加剂及填料。

ADVANTAGES OF COMPOSITE MATERIALS

Thanks to their exceptional mechanical, electrical and thermal properties, composite materials offer undeniable advantages in many areas of application, where they replace traditional metals and other alloys thanks to a set of superior properties, including:

- Low density (lightness)
- High dielectric properties
- Considerable chemical resistance (corrosion)
- High specific resistance and rigidity
- Very good fatigue resistance (cyclic loading)
- Excellent self-extinguishability and low combustion fume toxicity
- ECO-friendly

In addition, certain properties of composite materials can be adjusted by changing their design parameters, for example:

- Insulation or electrically-conductive
- Insulation or thermally-conductive
- Coefficient of thermal expansion
- Energy absorption (impact, acoustic) etc.

合成材料的优势

在卓越的机械、电气及热效性能的助力之下，合成材料可在众多应用领域突显出诸多不容置疑的优势，其不但可替代旧有的传统金属及合金，更拥有着下列更为非凡的性能：

- 密度较小（轻巧）
- 介电性能更强
- 耐化学（腐蚀）性能强大
- 特殊强度及刚性更高
- 优异的耐疲劳性（循环负载）
- 卓越的自熄性能及燃烧时的低烟雾毒性
- 生态友好型

此外，我们还可通过改变产品的设计参数来调整合成材料的某些性能，例如：

- 隔电性或导电性
- 隔热性或导热性
- 热膨胀系数
- 能量吸收（冲击、声音）……

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GCOMP RANGE

ORGANIC MATRIX COMPOSITES (OMC)

BOYD offers a complete range of organic matrix composites (OMC) in either **thermoset resin** (TS) or **thermoplastic resin** (TP). Thermoset resins are crosslinked thanks to an irreversible polymerisation process, which makes them **non-recyclable**. Conversely, thermoplastic resins are produced by a reversible fusion process, making them **recyclable**. OMCs are manufactured from reinforcements impregnated with resin by a low- or high-pressure production process.

HERE ARE SOME EXAMPLES OF TS AND TP RESINS REGULARLY USED:

THERMOSET RESINS (TS)

- Unsaturated polyester (UP)
- Vinyl ester (VE)
- Epoxy (EP)
- Phenolic (PF)
- Methacrylate (A)
- Polybismaleimides (BMI)
- Silicone (SI)
- Melamine (MF)…

THERMOPLASTIC RESINS (TP)

- Polyethylene (PE)
- Polypropylene (PP)
- Polyamide (PA)
- Polyimide (PI)
- Polybutylene terephthalate (PBT)
- Polyetherethercetone (PEEK)
- Poly(phenylene sulphide) (PPS)
- Poly(phenylene oxide) (PPO)…

GCOMP 系列

有机基质合成材料 (OMC)

BOYD 可为客户提供一整套完备的热固性树脂 (TS) 或热塑性树脂 (TP) 材质的有机基质合成材料 (OMC)。热固性树脂借助不可逆聚合流程结成网状结构，因此产品不可回收再生。而热塑性树脂则是通过可逆熔融流程生成，所以产品可以回收再生。在 (OMC) 生产伊始，首先要通过低压或高压工艺流程为加强体浸渍树脂。

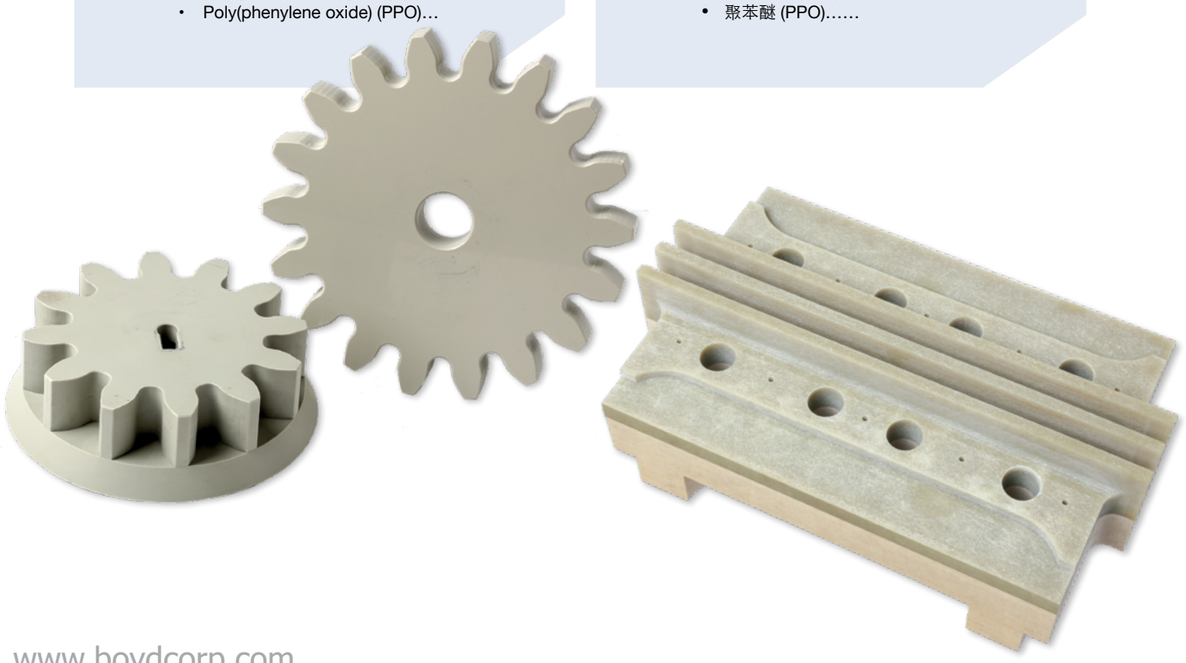
以下是一些常用的 TS 及 TP 树脂：

热固性树脂 (TS)

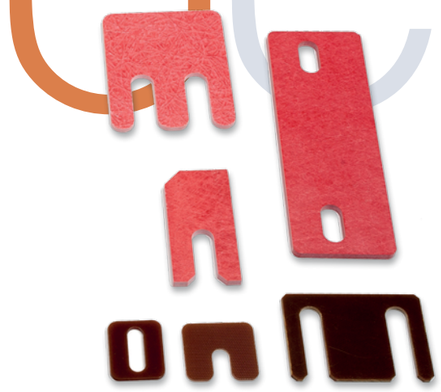
- 不饱和聚酯树脂 (UP)
- 乙烯基酯 (VE)
- 环氧树脂 (EP)
- 酚醛树脂 (PF)
- 异丁烯酸酯 (A)
- 双马来酰亚胺 (BMI)
- 硅 (Si)
- 三聚氰胺(MF)……

热塑性树脂 (TP)

- 聚乙烯 (PE)
- 聚丙烯 (PP)
- 聚酰胺 (PA)
- 聚酰亚胺树脂 (PI)
- 聚丁基对苯二甲酸乙二醇酯 (PBT)
- 聚醚醚酮 (PEEK)
- 聚苯硫醚 (PPS)
- 聚苯醚 (PPO)……



GCOMP



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REINFORCEMENTS

CAN BE CLASSIFIED ACCORDING TO THE FOLLOWING THREE MAIN CRITERIA:

THEIR CHEMICAL COMPOSITION

- Vegetable fibres (flax, hemp, jute, cotton, etc.)
- Synthetic fibres (polyester, aramid, UHMWPE, etc.)
- Mineral fibres (glass, basalt, carbon, etc.)
- Metallic fibres
- Cellulose paper, mica paper, Bakelite-coated paper

THEIR SIZE

- Short fibres (0.1 to 1 mm)
- Long fibres (1 to 50 mm)
- Continuous fibres (>50 mm)

THEIR ARCHITECTURE

- **Thread** (Roving)
- **Unidirectional web** (UD)
- **Woven**
  any type of woven fabric (glass cloth, carbon cloth, aramid cloth, etc.)
- **Non-woven**
  Glass mat, cut glass mat fibres or any other type of fibre with the same architecture

The mechanical, thermal and electrical properties of composite materials are essentially determined by the technical characteristics of the chosen resin-reinforcement combination.

加强体

可依照下列三个主要标准进行分类：

化学构成

- 植物纤维（亚麻、大麻、黄麻、棉纱……）
- 合成纤维（聚氨酯、芳纶、UHMWPE……）
- 矿物纤维（玻璃、玄武岩、碳……）
- 金属纤维
- 纤维素纸、云母纸、酚醛树脂纸

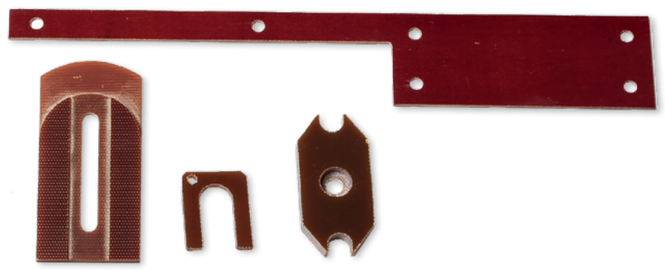
尺寸

- 短纤维（0.1 至 1 毫米）
- 长纤维（1 至 50 毫米）
- 或连续纤维（>50 毫米）

形状结构

- 线形（粗纱）
- 单向层面（UD）
- 纺织布：各种织物（玻璃布、碳布、芳纶布……）
- 无纺布：玻璃垫、
  切割玻璃垫纤维或其他各种拥有相同形状结构的纤维

合成材料的机械、热效及电气性能主要由所选树脂-加强体组合的技术特征决定。在经过切割、机械加工、模塑及压制成型等多个主要生产流程之后，铁路材料即可被加工为半成品或成品。



STRATIFIED COMPOSITE STRUCTURES

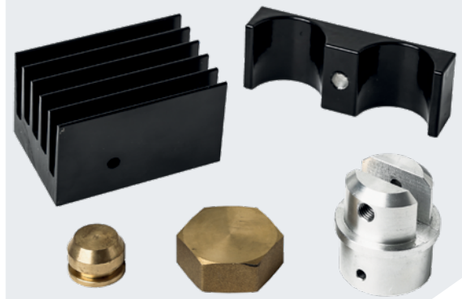
BOYD specialises in the manufacture and processing of **stratified composite structures** (SCS). SCSs are made up of successive **layers** of reinforcements impregnated with resin, known as pleats. These are formed from long-fibre reinforcements bonded by a resin. SCSs are often made up of unidirectional or bidirectional pleats that are extremely thin, in the order of several tenths of a millimetre. The desired mechanical properties are obtained by stacking pleats in layers, each one of which is oriented differently.

MANUFACTURE

AN ULTRA-MODERN MACHINING CENTRE

Thanks to its expertise in the **machining of composite materials** (**cutting, milling, turning, drilling and tapping**) and to ultra-modern machinery that includes several milling tables and machine centres with 3 to 5 spindles, **BOYD** is able to meet the most stringent customer requirements. All machined parts supplied by **BOYD** to its customers meet the quality criteria, for example dimensional tolerance and surface condition, required by the principal international standards:

- IEC/EN 60893
- NEMA LI.1
- DIN 7735
- NFC 26153/26154
- JIS



Metallic parts

层压合成结构

BOYD 可专业从事层压合成结构 **(SCS)** 的生产及加工。**SCS** 由浸渍着树脂的加强体连续层（被称为叠层）构成。而这些叠层则由以树脂连接的长纤维加强体组成。一般来讲，**SCS** 内往往含有众多单向或双向叠层，且这些叠层的厚度极薄，每个仅几丝米厚。技术人员可通过调整各层间的叠层堆叠方向，来获得所需的机械性能。

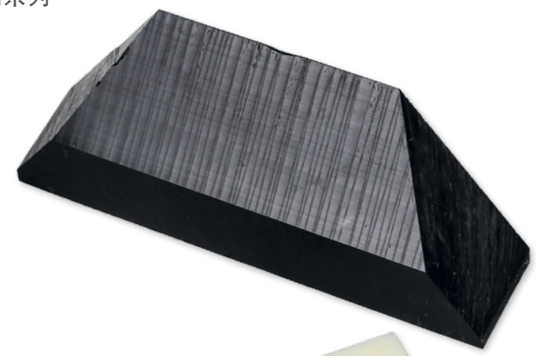
生产制造

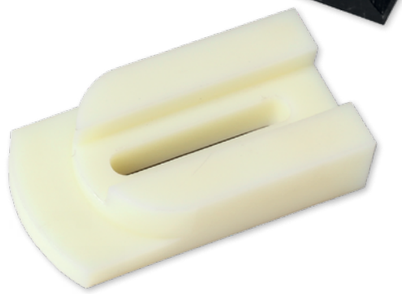
超级现代的机械加工中心

BOYD 可凭借其在合成材料机械加工领域的专业技术（切割、铣削、车削、钻孔及攻丝），以及由众多铣削工作台及 **3** 至 **5** 轴机械加工中心 组成的超级现代设备园区，完美满足客户最严苛的各种要求。**BOYD** 向客户提供的所有机加工部件，均可完全符合以下主要国际标准要求的质量标准（如尺寸公差、表面状态等）：

- IEC/EN 60893
- NEMA LI.1
- DIN 7735
- NFC 26153/26154
- JIS

GCOMP PRODUCT RANGE GCOMP 产品系列





A LARGE RANGE OF SEMI-FINISHED AND FINISHED PRODUCTS

Composite materials are processed into semi-finished or finished products using several manufacturing methods, chiefly **machining**, **stamping**, **moulding** and **pultrusion**. The resulting products are available in several forms:

- Laminate panels
- Machined parts
- Tubes, cylinders and bars
- Round and threaded rods
- Tailor-made pultruded profiles
- Tailor-made moulded parts

APPLICATIONS FOR COMPOSITE MATERIALS

are many and varied, the main ones being:

- Electrical insulation
- Thermal insulation
- Chemical resistance (corrosion)
- Resistance to abrasion and wear
- Resistance to humidity, salt water, dielectric liquids, etc.

THESE APPLICATIONS ARE AIMED AT VARIOUS SECTORS OF ACTIVITY, INCLUDING:

- Rail, maritime and air transport
- Electronic/electric
- Medical
- Textile
- Household appliances
- Paper industry
- Energy industry
- Mechanical industry, etc.

种类齐全的成品及半成品系列

在经过机械加工、冲压、模塑或挤压拉伸等多个主要生产流程之后，合成材料即可被加工为半成品或成品。且产品有以下多种方式可供选择：

- 层压板
- 机加工部件
- 管件、滚筒及棒材
- 圆形螺纹杆
- 定制化挤压拉伸型材
- 定制化模塑部件

合成材料的应用

非常广泛且极其多变，其中主要包括

- 隔电
- 隔热
- 耐化学（腐蚀）
- 耐磨损
- 耐潮湿、耐盐水、耐介质溶液.....

这些应用可满足众多业务领域内的需求，具体包括：

- 铁路运输、海运及空运
- 电子/电力
- 医疗
- 纺织
- 家用电器
- 造纸工业
- 能源工业
- 机械工业.....

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ISO 9001

QUALITY CONTROL AND ISO 9001 CERTIFICATION

Over the years, **BOYD** has equipped itself with human and material resources that guarantee systematic and strict quality control after each production run. Our internal quality control laboratory (QCL) allows us to carry out visual and dimensional checks quickly, as well as those of certain basic mechanical properties such as shore hardness, tensile strength and resistance to compression. For more detailed analyses, **BOYD** works in partnership with several industrial and university laboratories in Europe. Since 2008, **ISO 9001 certification** has been successfully renewed each year.

质量控制与 ISO 9001 认证

多年以来，**BOYD** 始终在使用最为先进的人力及物力方法，确保对每个生产环节进行严格而系统的质量控制。我们的内部质量控制实验室 (QCL)，可帮助操作者快速完成尺寸目测控制及诸如肖氏硬度、抗拉强度及抗压强度等某些基础机械性能的测试。对于那些更为尖端的分析，**BOYD** 则会与欧洲的多所工业实 验室及大学实验室合作完成。

自 2008 年以来，**BOYD** 每年都会成功通过 **ISO 9001** 认证年审。

CERTIFICATION ISO 9001 BQA

BQA_QMS_C_2007342

REACH COMPLIANT

RoHS

BOYD TRUSTED INNOVATION

复合材料： GCOMP 和 GRAIL 产品系列[1]

	树脂	酚醛树脂			不饱和聚酯		环氧树脂					
	增强	玻璃纤维布	胶木纸	棉布	短切玻璃纤维	玻璃纤维板	玻璃纤维布	玻璃纤维布	玻璃纤维板	粗纱	纺/无纺	聚酯
	参考	GRAIL-WSPG3-FR	GRAIL-PHCP-FR	GCOMP-PHCC-1	GRAIL-PGUTR-FR	GRAIL-PGGM-FR	GRAIL-EP0GC-FR	GCOMP-EP0GC-EN	GCOMP-EP0GM-1	GRAIL-EPORO-FR	GRAIL-EP0WN-FR	GRAIL-EP0PE-FR
基本特性	标准颜色	红棕色	棕色	黑色	红色	白色	深黄色	绿色的	黄色	自然色	乳白色	-
	密度 (g/cm³)	1,9	1,4	1,45	1,81	1,8	2	2,1	1,85	2	2	1,32
	阻燃防烟标准 [2,3]	EN 45545	UL-94	-	EN 45545	EN 45545	EN 45545	EN 45545	-	-	-	UL-94
国际标准	EN 60893/IEC 60893	PFGC201	PFCP201	PFCC204	UPGM203	UPGM203	EPGC202 (HFD)	EPGC203	EPGM203	EPGC 205		EPPC301
	DIN 7735	-	-	-	-	HM 2471	-	-	-	HGW 2370.4		-
	NEMA LI.1	G-3	-	LE	GPO-3	GPO-3	FR-4	G-11	-	G-11		-
	NFC 26153/26151	-	-	-	-	VmP2e	-	-	VmEM2	VtEM2		-
	JIS	PL-GH	-	PL-FLE	TL-GEF	-	EL-GEF	EL-GEH	-	-		-

	树脂	硅树脂			三聚氯胺	聚酰亚胺	聚酰胺	聚碳酸脂	弹性体
	增强	玻璃纤维布	白云母纸	金云母纸	玻璃纤维布	玻璃纤维布	玻璃纤维布	玻璃纤维布	芳纶纤维
	参考	GRAIL-SIGC-FR	GRAIL-SIPM-FR	GRAIL-SIPP-FR	GRAIL-MEGC-FR	GRAIL-PIGC301	GRAIL-PAGF-FR	GRAIL-PCGF-FR	GRAIL-BA55
基本特性	标准颜色	白色	灰色的	深绿色	白色	棕红色	黑色	半透明	绿色
	密度 (g/cm³)	1,95	2,1	2,2	1,95	1,9	1,29	1,27 1,43	-
	阻燃防烟标准 [2,3]	UL-94	UL-94	UL-94	UL-94	UL-94	UL-94	UL-94	-
国际标准	EN 60893/IEC 60893	SIGC202	IEC 60371-3-3 HP5	IEC 60371-3-3 HP5	MFGC201	PIGC301			-
	DIN 7735	-	-	-	HGW 2272				-
	NEMA LI.1	G-7	-	-	G-5				-
	NFC 26153/26151	-	-	-	-				-
	JIS	SLOGSH	-	-	ML-GMH				-

1 树脂增强配对产品部分目录

2 要获取 **GCOMP** 和 **GRAIL** 系列内的任何产品的技术数据表和/或阻燃防烟证书，请通过 **WWW.GRANDOGROUP.COM** 或 **INFO.NIVELLES@BOYDCORP.COM** 与我们联系。

3 可以根据要求进行以下国际标准的阻燃防烟认证：
EN 45-545, NF-F16-101, DIN 5510-2, BS 6853, UNI CEI 11170-3, ASTM C542/E662, UL-94, GOST… 。

TABLE: COMPOSITE MATERIALS FROM PRODUCT RANGES GCOMP and GRAIL[1]

	RESIN	PHENOLIC			UNSATURATED POLYESTER		EPOXY					
	REINFORCEMENT	Glass fiber cloth	Bakelite paper	Cotton cloth	Chopped glass fiber	Glass mat	Glass fiber cloth	Glass fiber cloth	Glass mat	Roving	Woven/NW	Polyester
	REFERENCE BOYD	GRAIL-WSPG3-FR	GRAIL-PHCP-FR	GCOMP-PHCC-1	GRAIL-PGUTR-FR	GRAIL-PGGM-FR	GRAIL-EP0GC-FR	GCOMP-EP0GC-EN	GCOMP-EP0GM-1	GRAIL-EPORO-FR	GRAIL-EP0WN-FR	GRAIL-EP0PE-FR
GENERAL PROPERTIES	Standard colour	Brown-red	Brown	Black	Red	White	Dark yellow	Green	Yellow	Natural	Cream	-
	Density (g/cm3)	1,9	1,4	1,45	1,81	1,8	2	2,1	1,85	2	2	1,32
	Fire and Smoke Standards [2,3]	EN 45545	UL-94	-	EN 45545	EN 45545	EN 45545	EN 45545	-	-	-	UL-94
INTERNATIONNAL STANDARDS	EN 60893/IEC 60893	PFGC201	PFCP201	PFCC204	UPGM203	UPGM203	EPGC202 (HFD)	EPGC203	EPGM203	EPGC 205		EPPC301
	DIN 7735	-	-	-	-	HM 2471	-	-	-	HGW 2370.4		-
	NEMA LI.1	G-3	-	LE	GPO-3	GPO-3	FR-4	G-11	-	G-11		-
	NFC 26153/26151	-	-	-	-	VmP2e	-	-	VmEM2	VtEM2		-
	JIS	PL-GH	-	PL-FLE	TL-GEF	-	EL-GEF	EL-GEH	-	-		-

	RESIN	SILICONE			MELAMINE	POLYIMIDE	POLYAMIDE	POLYCARBONATE	ELASTOMER
	REINFORCEMENT	Glass fiber cloth	Mica paper muscovite	Mica paper phlogopite	Glass fiber cloth	Glass fiber cloth	Glass fiber cloth	Glass fiber cloth	Synthetic fibers + NBR binder
	REFERENCE BOYD	GRAIL-SIGC-FR	GRAIL-SIPM-FR	GRAIL-SIPP-FR	GRAIL-MEGC-FR	GRAIL-PIGC301	GRAIL-PAGF-FR	GRAIL-PCGF-FR	GRAIL-BA55
GENERAL PROPERTIES	Standard colour	White	Grey	Dark Green	White	Red Brown	Black	Translucent	Green
	Density (g/cm3)	1,95	2,1	2,2	1,95	1,9	1,29	1,27 1,43	-
	Fire and Smoke Standards [2,3]	UL-94	UL-94	UL-94	UL-94	UL-94	UL-94	UL-94	-
INTERNATIONNAL STANDARDS	EN 60893/IEC 60893	SIGC202	IEC 60371-3-3 HP5	IEC 60371-3-3 HP5	MFGC201	PIGC301			-
	DIN 7735	-	-	-	HGW 2272				-
	NEMA LI.1	G-7	-	-	G-5				-
	NFC 26153/26151	-	-	-	-				-
	JIS	SLOGSH	-	-	ML-GMH				-

1 Non-exhaustive list of resin-reinforcement pairs

2 TO OBTAIN TECHNICAL DATA SHEETS AND/OR FIRE AND SMOKE CERTIFICATES FOR ANY PRODUCT OF THE GCOMP AND GRAIL RANGES, CONTACT US AT WWW.GRANDOGROUP.COM OR AT INFO.NIVELLES@BOYDCORP.COM

3 FIRE AND SMOKE ACCREDITATIONS FOR THE FOLLOWING INTERNATIONAL STANDARDS CAN BE DONE UPON REQUEST: EN 45-545, NF-F16-101, DIN 5510-2, BS 6853, UNI CEI 11170-3, ASTM C542/E662, UL-94, GOST... .

GCOMP PRODUCT RANGE GCOMP 产品系列

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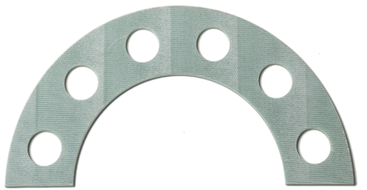

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BOYD makes an engineering office available to its customers that is experienced in the design of any new component. Our engineers use advanced software to design any new technical part, such as Catia, Rhinoceros, Mastercam, Autocad, etc. With solid experience in materials engineering and staff who are highly qualified in the chemistry and physics of materials, **BOYD** undertakes to find an optimal solution to your specific technical needs.

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BOYD 拥有经验丰富的工程办公室，能够在各类新部件的设计及构思方面为客户提供卓越服务。我们的工程师将运用先进软件(如Catia、Rhino、Mastercam、Autocad) 设计任何全新技术部件。而且，**BOYD** 在材料工程领域经验深厚并拥有大批材料化学及物理学科方面的高端人才，定可为您找到满足您具体技术需求的最佳解决方案。

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CERTIFICATION ISO 9001 BQA

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