

BOYD

TRUSTED INNOVATION

RAILWAY INDUSTRY · 铁路工业



BOYD - WORLDWIDE ENGINEERED MATERIALS - SINCE 1928

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.

THE RAIL INDUSTRY

ONE OF BOYD'S FLAGSHIP SECTORS

Among the numerous areas in which **BOYD** operates, rail has become one of its privileged sectors, whether from a commercial or technical point of view. With more than 20 years' experience in the rail sector, our specialist materials science engineers develop **low-smoke toxicity self-extinguishing materials (halogen-free)** specifically for rail applications and, also more generally, for the transport industry. Thanks to its experience and its reputation, **BOYD** has become a major supplier of accredited normative materials for the rail sector.

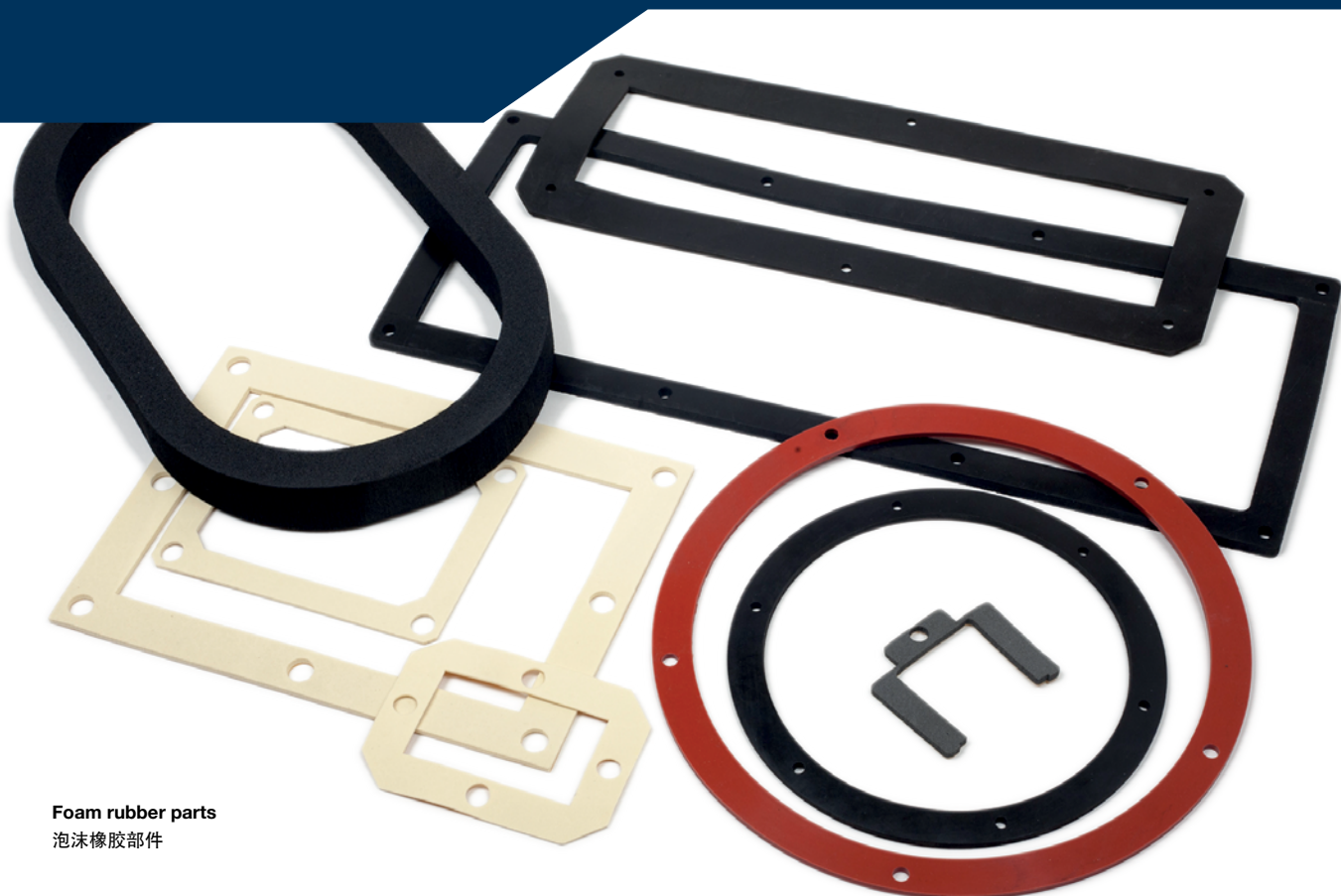
BOYD NIVELLES 公司

BOYD 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** 还在近些年内大大拓宽了自身的合成及热塑性材料系列产品。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、泡沫塑料及热塑性材料），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** 的愿望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。

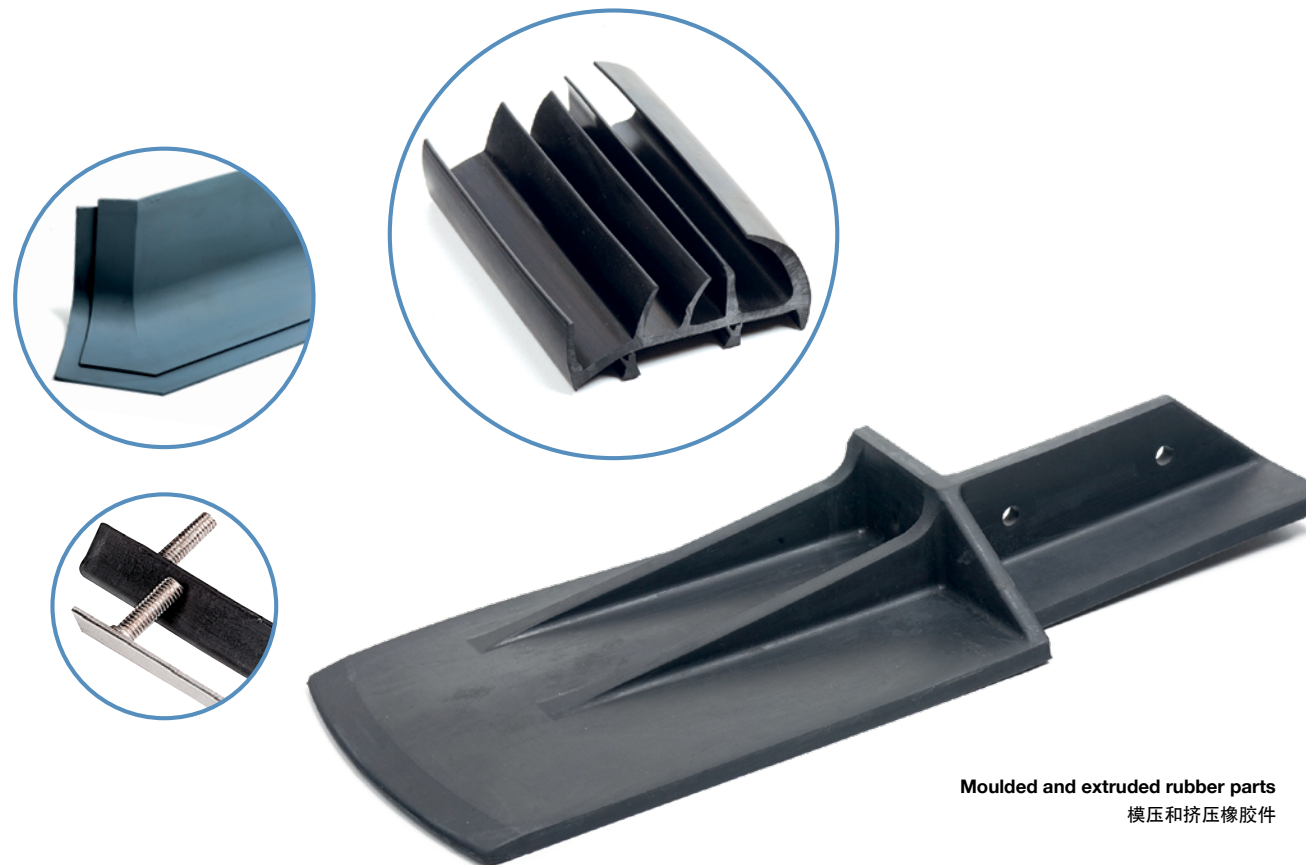
铁路工业

BOYD 的标志性领域之一

无论是从商业抑或技术角度来讲，在 **BOYD** 涉猎的众多业务领域中，铁路工业始终是其重点关注的行业之一。我们的材料科学工程师在铁路领域拥有着二十多年的丰富经验，他们专为铁路行业以及更为广义的运输工业，研发了大量低烟雾毒性的自熄型材料（无卤化产物）。在丰富经验与卓越声誉的助力之下，**BOYD** 业已成为了铁路行业规范认可材料不容错过的最佳供应商。



Foam rubber parts
泡沫橡胶部件



Moulded and extruded rubber parts
模压和挤压橡胶件

OUR MAIN OBJECTIVE PASSENGER SAFETY

To improve passenger safety, train operators and builders are imposing ever stricter fire/smoke standards. In response to this demand, **BOYD** has for several years been developing and manufacturing materials that meet the new technical requirements in collaboration with **several R&D laboratories and other industrial partners**.

Over the years, **BOYD** has managed to develop an increasingly complete range of rail products in terms of category of product and fire/smoke classification, while significantly improving their self-extinguishing performance as well as eliminating halogen emissions. Aware that current national European standards will eventually be replaced by **a single European standard, EN 45-545**, **BOYD** already offers its customers a varied range of products classified according to this standard, making it an **undisputed leader** on this niche market. **All our materials are accredited in accordance with at least one of the following international fire/smoke standards:**

EUROPEAN FIRE-SMOKE STANDARDS

- NF F16-101/NF F16-102 (French standard)
- DIN 5510 (German standard)
- BS 6853 (British standard)
- UNI (EN ISO 11925-2:2002) (Italian standard)
- **EN 45-545** (European standard)

NORTH AMERICAN FIRE-SMOKE STANDARD

- ASTM C1166, E162, E662
- UL 94

RUSSIAN FIRE-SMOKE STANDARD

- GOST

These materials can also be developed specifically according to customers' technical and normative criteria.

我们的主要目标 乘客安全

为了保证乘客安全，列车的运营商及制造商强制规定了越来越严苛的消防-排烟标准。为满足这一需求，**BOYD** 多年来始终致力于与多家研发实验室及其他工业伙伴携手合作，开发并生产出了可完全符合各项全新要求的高科技材料。

随着光阴的流逝，**BOYD** 已成功开发出一整套产品类型及消防-排烟等级愈发完备的铁路产品系列，与此同时，它更显著改进了这些产品的自熄性能，并消除了产品的卤化产物排放问题。鉴于欧洲各国的当前国家标准将最终被欧洲统一标准 **EN 45-545** 取代，**BOYD** 现在就可为客户提供按照此标准要求进行分类的产品系列，这一举措使得 **BOYD** 再次成为了此细分市场上毋庸置疑的领军企业。我们的所有产品均至少获得了一项下列国际消防-排烟标准的认证认可：

欧洲消防-排烟标准

- NF F16-101/NF F16-102 (法国标准)
- DIN 5510 (德国标准)
- BS 6853 (英国标准)
- UNI (EN ISO 11925-2:2002) (意大利标准)
- **EN 45-545** (欧洲标准)

北美消防-排烟标准

- ASTM C1166, E162, E662
- UL 94

俄罗斯消防-排烟标准

- GOST

此外，我们还可根据客户的技术规范标准对这些材料进行特别开发。

MATERIALS ACCREDITED FOR THE RAIL SECTOR

GRAIL

BOYD offers a complete range of accredited normative materials for the rail sector, the **GRAIL** range. This range includes the four main categories of material processed by BOYD, namely, **elastomers**, **foams** (cellular rubbers and expanded plastics), **thermoplastics** and **composites**, as well as certain special materials (see Table)

ELASTOMERS

- EPDM
- Neoprene (CR)
- Silicone (Si)
- Polyurethane (PUR)

FOAMS

- EPDM
- EVM
- PVC/NBR
- Neoprene (CR)
- Silicone (Si)
- Polyethylene (PE)
- Polyurethane (PUR)
- Melamine

THERMOPLASTICS

- Polyamide (PA), Polycarbonate (PC), Polypropylene (PP)

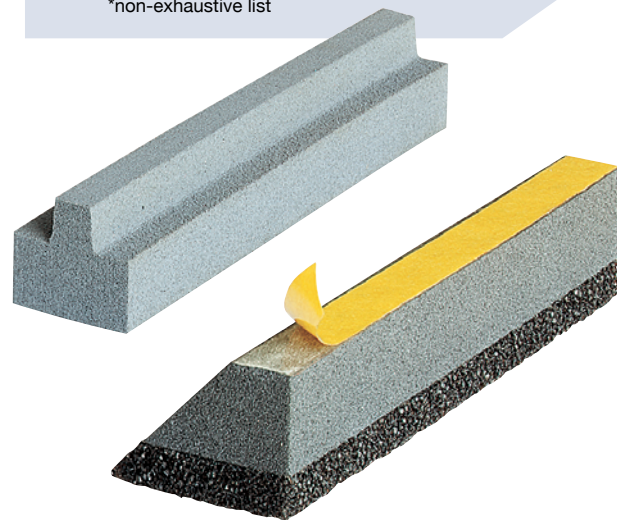
COMPOSITES (resin/reinforcement)*

- Phenolic / glass cloth
- Polyester / glass mat
- Epoxy / glass cloth
- Silicone / glass cloth
- Melamine / glass cloth
- Polyimide / glass cloth
- Polycarbonate / glass cloth

SPECIAL MATERIALS

- woollen felt, non-woven PET

*non-exhaustive list



铁路行业认可材料

GRAIL 系列

BOYD 可为客户提供一整套完备的铁路行业规范认可材料系列产品，即 **GRAIL** 系列。该系列包含四种主要材料类别（均由 BOYD 加工而成），即弹性材料、泡沫材料（海绵橡胶及泡沫塑料）、热塑材料及合成材料，此外，以及某些特殊材料（见表）。



弹性材料

- EPDM
- 氯丁橡胶 (CR)
- 硅 (Si)
- 聚氨酯 (PUR)

泡沫材料

- EPDM
- EVM
- PVC/NBR
- 氯丁橡胶 (CR)
- 硅 (Si)
- 聚乙烯 (PE)
- 聚氨酯 (PUR)
- 三聚氰胺

热塑材料

- 聚酰胺 (PA)、聚碳酸 (PC)、聚丙烯 (PP)

合成材料 (树脂/加强体)*

- 酚醛树脂/玻璃布
- 聚酯树脂/玻璃垫
- 环氧树脂/玻璃布
- 硅树脂/玻璃布
- 三聚氰胺树脂/玻璃布
- 聚酰胺树脂/玻璃布
- 聚碳酸树脂/玻璃布

特殊材料

- 玻璃棉毡垫, PET 无纺布

*不完全清单

GRAIL

For all normative sectors such as rail and aeronautics, BOYD requires its raw material suppliers' products to meet the **REACH** and **RoHS** European quality standards.

THESE MATERIALS ARE MAINLY USED FOR THE FOLLOWING RAILWAY APPLICATIONS:

- Air and water tightness
- Dust and air tightness
- Fire and smoke resistance
- Expansion
- Electrical insulation
- Thermal insulation
- Acoustic/phonoc insulation
- Anti-slip protection, etc.

... AND PROCESSED INTO FINISHED PRODUCTS IN VARIOUS FORMS:

- Sealing profiles
- Expansion joints
- Profiles for doors and windows
- Frames and welded rings
- Bellows
- Connection for ventilation duct
- Any part moulded in rubber or plastic, with or without metallic insert, etc.

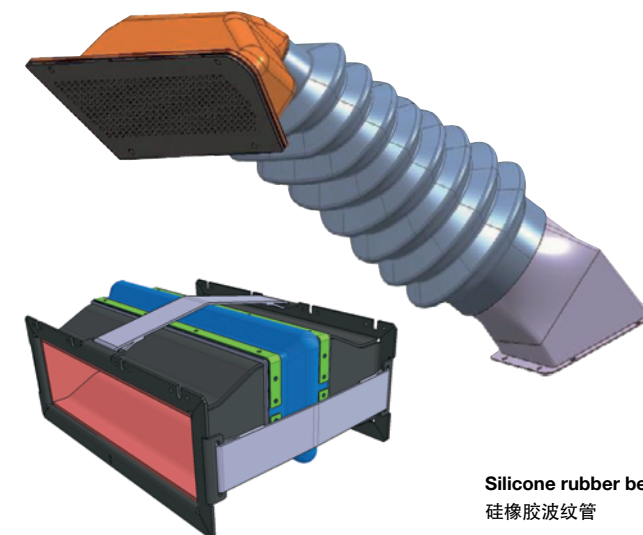
对于铁路及航空等各种标准领域的产品，BOYD 均会特别要求原材料供应商，所供货品必须符合 **REACH** 及 **RoHS** 欧洲质量标准。

这些材料主要用于以下铁路应用领域：

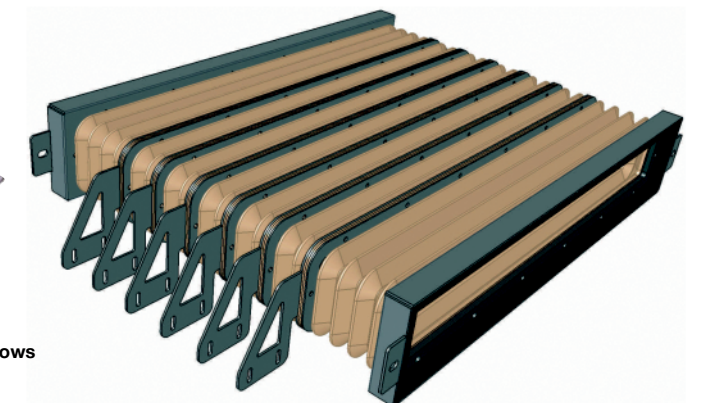
- 密封防水、防气
- 密封防尘、防气
- 耐火、耐烟
- 膨胀
- 隔电
- 隔热
- 隔音
- 防滑保护等……

……并可加工成以下各种形状的成品：

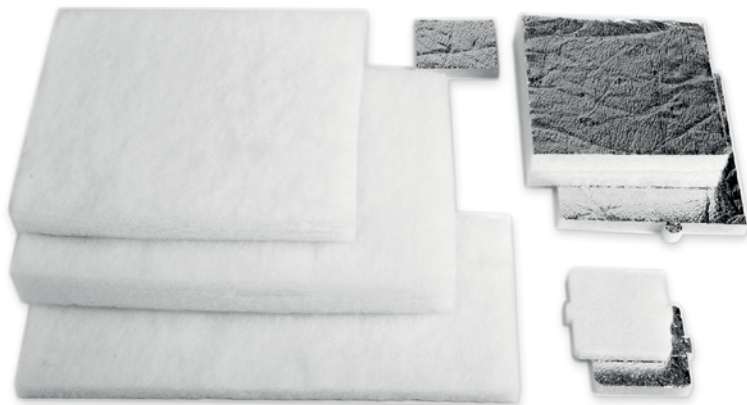
- 密封型材
- 膨胀接头
- 门窗型材
- 焊接框架及焊接环
- 风箱
- 通风套管接缝
- 带或不带金属嵌入物的任何橡胶或塑料模压部件等



Silicone rubber bellows
硅橡胶波纹管



Non-woven PET for sound and thermal insulation
用于隔音和隔热的涤纶无纺布



Extruded rubber profiles with metal insert

经验丰富的工程办公室

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、Rhinceros、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。

AN EXPERIENCED ENGINEERING FIRM

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, Rhinceros, 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.

卓越非凡的商务部门

从商务角度来看，BOYD 具备生产周期超短、售后服务反应迅速以及性价比极具竞争力等诸多突出优势。这些制胜关键与其他强弱点一起，成就了 BOYD 在铁路行业及广义运输领域新材料生产及研发 (R&D) 市场上的领导者地位。

A HIGH-END COMMERCIAL DEPARTMENT

Commercially, BOYD is known for its very short production lead times, the responsiveness of its after-sales service and a highly competitive price/quality ratio. These assets, among others, make it one of the market leaders in the development (R&D) and manufacture of new materials for the rail sector, and the transport sector in general.

满足客户需求是我们每天的目标

MANUFACTURE ULTRA-MODERN MACHINERY

Thanks to a policy of continuous investment in its machinery and industrial buildings for many years, BOYD is equipped with numerical control (CNC) machines that are among the best-performing on the market and capable of meeting the most stringent customer requirements. All parts manufactured by BOYD meet the quality criteria (dimensional tolerance, surface condition, etc.) required by the principal international standards as well as the customer's specifications. Railway materials are processed into semi-finished or finished products using several manufacturing methods, chiefly cutting, machining, moulding and extrusion.

生产制造 超级现代的设备园区

多年以来，在面向设备园区及工业厂房的持续投资政策助力之下，BOYD 现已拥有了市场上最为先进的数控设备 (CNC)，并可满足客户最为严苛的各种要求。BOYD 生产的所有部件均严格符合主要国际标准及客户产品规格要求的质量标准（尺寸公差、表面状态等.....）。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。

SATISFYING CUSTOMER NEEDS IS OUR MAIN OBJECTIVE - EVERY DAY



Machined thermoplastic parts
加工的热塑性塑料部件



BOYD - WORLDWIDE SUPPLIER OF THE RAILWAY INDUSTRY

THE RESULTING PRODUCTS ARE AVAILABLE IN THE FORM OF

- Stamped parts
- Machined parts
- Moulded parts
- Extruded profiles

Other processing methods such as gluing, laminating, overmoulding, etc. are regularly used in our workshops to manufacture more complex parts.

可以提供以下几种形状的产品

- 切割部件
- 机加工部件
- 模塑部件
- 挤压型材

此外，我们的工厂也会经常运用粘合、络合、复制模型等其他加工流程来生产更为复杂的部件。

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.

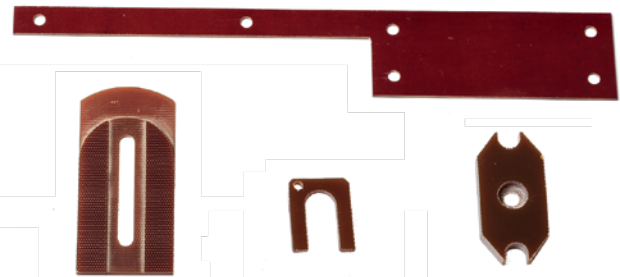


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质量控制与 ISO 9001 认证

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。



Machined composite parts
加工的复合材料部件

	材料类型	密度(kg/m ³)	泡孔类型	产品参考资料	应用	终端产品类型
海绵橡胶	氯丁海绵橡胶, 黑色, 4 层皮	± 500	闭孔	GRAIL-9930-FR	密封	型材
	EVM海绵橡胶, 米色	± 365	闭孔	GRAIL-9032-EN	密封	
	氯丁海绵橡胶, 中灰色	± 200	闭孔	GRAIL-9923-EN	密封, 减震	
	硅胶海绵, 淡灰色	± 200	闭孔	GRAIL-SILCEL-EN	密封, 减震, 隔热和隔音	
	EPDM海绵橡胶, 深灰色	± 175	闭孔	GRAIL-9023-EN	密封, 减震	
	合成海绵橡胶, 蓝色	± 100	闭孔	GRAIL-9404-EN	隔热, 抗菌保护	
	PVC/NBR海绵橡胶, 黑色	± 60	闭孔	GRAIL-9401-FR	密封, 减震	
	PVC/NBR海绵橡胶, 黑色	± 55	闭孔	GRAIL-9701-FR	隔热, 减震	
	PVC/NBR海绵橡胶, 灰色	± 50	闭孔	GRAIL-9403-EN	密封, 减震	
	PVC/NBR海绵橡胶, 灰色	± 50	闭孔	GRAIL-9403-FR	密封, 减震	
泡沫塑料	聚氨酯泡沫塑料, 黑色	± 75	开孔	GRAIL-PUR-FR	隔音, 减震	卷材, 板材, 带材和垫片
	聚氨酯泡沫塑料, 黑色	± 60	开孔	GRAIL-PUR-EN	隔音, 减震	
	PE泡沫, 煤灰色	± 30	闭孔	GRAIL-0022-FR	密封, 隔热, 热压缩	
三聚氰胺泡沫	± 10	开孔	GRAIL-0702-FR	隔音		

	材料类型	硬度, 邵氏硬度A	颜色	产品参考资料	应用	终端产品类型
弹性体	EPDM	± 40	黑色	GRAIL-1040-EN	密封, 减震	型材, 带材, 垫片, 模制件
	EPDM	± 60	黑色	GRAIL-1060-EN	密封, 减震	
	EPDM	± 70	黑色	GRAIL-1070-FR	密封, 高低温应用, 减震	
	氯丁橡胶	± 40	黑色	GRAIL-1941-FR	密封, 减震	
	氯丁橡胶	± 60	黑色	GRAIL-FR-CR-65	密封, 减震	
	硅树脂	± 50	灰色或白色	GRAIL-SI50-FR	密封, 高低温应用, 减震	
	硅树脂	± 50	灰蓝色	GRAIL-SI50-EN	密封, 高低温应用, 减震	
	硅树脂	± 60	米色	GRAIL-SI60-FR	密封, 高低温应用, 减震	
	硅树脂	± 60	灰蓝色	GRAIL-SI60-EN	密封, 高低温应用, 减震	
	硅树脂	± 65	深灰色	GRAIL-SI65-FR	密封, 高低温应用, 减震	
	硅树脂	± 70	灰色或白色	GRAIL-SI70-FR	密封, 高低温应用, 减震	
	硅树脂	± 75	灰蓝色	GRAIL-SI75-EN	密封, 高低温应用, 减震	

	树脂	增强材料	颜色	产品参考资料	性能	终端产品类型	
复合材料	热固性塑料	酚醛树脂	玻璃纤维布	棕色	GRAIL-WSPG3-FR	出色的电绝缘和机械性能。高阻阻燃等级。	加工件, 模制件
		酚醛树脂	纤维素纸	浅棕色	GRAIL-PHCP-FR	出色的低压电绝缘性。优良的机械性能。冲压件。	
		不饱和聚酯	短切玻璃纤维	红色	GRAIL-PGUTR-FR	出色的电气和热绝缘性能 (高达160°C)。高耐电痕和耐电弧性。高阻阻燃等级。	
		不饱和聚酯	玻璃纤维板	白色	GRAIL-PGGM-FR	出色的电气和热绝缘性能 (高达155°C)。高耐电痕和耐电弧性。高阻阻燃等级。	
		环氧树脂	玻璃纤维布	深黄色	GRAIL-EPOGC-FR	出色的机械性能。优良的电气绝缘性能和高耐温性。	
		环氧树脂	粗纱	天然	GRAIL-EPORO-FR	出色的机械和电绝缘性能。高耐电痕和耐电弧性。高耐温性(180°C)。增强粗纱。	
	环氧树脂	织物/非织物	米色	GRAIL-EPOWN-FR	出色的电气绝缘性能。优良的机械性能。高阻阻燃等级。	加工件, 模制件, 拉挤型材	
	环氧树脂	聚酯		GRAIL-EPOPE-FR	优良的电绝缘和机械性能。优良的耐磨性和抗撕裂性以及出色的柔韧性。高耐温性 (150°C)。		
	环氧树脂	棉布	红色	GRAIL-EPOCC-FR	优良的机械和出色的电绝缘性能。出色的耐磨性和抗撕裂性能。高柔韧性。低吸水性。		
	硅树脂	白云母纸		GRAIL-SIPM-FR	出色的电气和热 (450到800°C) 绝缘性能。优良的机械性能。高阻阻燃等级。		
	硅树脂	金云母纸		GRAIL-SIPP-FR	出色的电气和热(600°C)绝缘性能。优良的机械性能。		
	硅树脂	玻璃纤维布	白色	GRAIL-SIGC-FR	出色的耐热性(220°C)。在干湿环境中高起痕指数和出色的介电性能。		
热塑性塑料	聚酰亚胺	玻璃纤维布	深棕色	GRAIL-PIGC301	出色的热阻 (高绝缘体) 和机械性能。出色的耐溶剂性和耐介电液体性能。	加工件, 模制件	
	三聚氰胺	玻璃纤维布	白色	GRAIL-MEGC-FR	硬度极高材料, 出色的耐水、耐化学品和阻燃性。出色的电气性能, 具有高耐电弧和耐电痕性。		
	聚酰胺	玻璃纤维布	黑色	GRAIL-PAGF-FR	出色的机械特性 (高刚性和抗压强度) 温度范围宽, 从-20°C到+120°C。高热变形温度。		
	聚碳酸酯	玻璃纤维布	透光率 (窗口级)	GRAIL-PCGF-FR	阻燃, 玻璃纤维增强半透明聚碳酸酯, 适用于要求更高硬度的应用。		
	弹性体	芳纶纤维	绿色	GRAIL-BA-55	高阻阻燃等级。高耐温性 (持续270 °C, 峰值350 °C)。非常好的耐蒸汽和化学品性能。		

	材料类型	密度(kg/m3)	颜色	产品参考资料	性能	终端产品类型
热塑性塑料	聚酰胺(PA)	1,17	天然, 黑色	GRAIL-PA6-EN	无卤素, 阻燃, 高强度和刚度, 低密度等级	挤压型材, 加工件, 模制件 加工件, 模制件 注塑件
	聚碳酸酯(PC)	1,2	透明	GRAIL-POLYCARBONATE-FR	高透光率, 高冲击强度, 温度从-100°C到+120°C	
	聚丙烯(PP)	0,98	天然, 黑色	GRAIL-PP-FR	低耐冲击性, 阻燃PP	

(其它颜色根据需要提供)

	材料类型	密度(kg/m3)	颜色	产品参考资料	应用	终端产品类型
特殊材料	羊毛毡	± 200	米色, 黑色	GRAIL-L5FB	密封, 减震	卷材, 板材, 切片件
	羊毛毡	± 300	米色, 黑色	GRAIL-L3FB	密封, 减震	
	涤纶无纺布	± 30	白色	GRAIL-SOUND-EN	隔热和隔音	

- 根据国际惯例进行阻燃防烟认证:
EN 45-545, NF-F16-101, DIN 5510-2, BS 6853, UNI CEI 11170-3, ASTM C542/E662, UL-94, GOST.....
- 要获取以上任何产品的技术数据表和/或阻燃防烟证书, 请通过WWW.GRANDOGRUP.COM或INFO-NIVELLES@BOYDCORP.COM与我们联系。

- 带或不带金属嵌件的挤压型材。
- 树脂增强配对产品部分目录。
- 带或不带铝箔和/或带或不带压敏粘合剂(PSA)的无纺聚酰胺。

POLYMERS & COMPOSITES for the RAILWAY INDUSTRY: the **GRAIL** Product Range^{1, 2}

	MATERIAL TYPE	DENSITY (kg/m³)	CELL TYPE	PRODUCT REFERENCE	APPLICATIONS	END-PRODUCT TYPE
SPONGE RUBBERS	Neoprene sponge rubber, black, 4 skins	± 500	Closed cell	GRAIL-9930-FR	Sealing	Profiles Rolls Sheets Strips Gaskets
	EVM sponge rubber, beige	± 365	Closed cell	GRAIL-9032-EN	Sealing	
	Neoprene sponge rubber, medium grey	± 200	Closed cell	GRAIL-9923-EN	Sealing, shock absorption	
	Silicone sponge, light grey	± 200	Closed cell	GRAIL-SILCEL-EN	Sealing, shock absorption, thermal and sound insulation	
	EPDM sponge rubber, dark grey	± 175	Closed cell	GRAIL-9023-EN	Sealing, shock absorption	
	Synthetic sponge rubber, blue	± 100	Closed cell	GRAIL-9404-EN	Thermal insulation, antimicrobial protection	
	PVC/NBR sponge rubber, black	± 60	Closed cell	GRAIL-9401-FR	Sealing, shock absorption	
	PVC/NBR sponge rubber, black	± 55	Closed cell	GRAIL-9701-FR	thermal insulation, vibration dampening	
	PVC/NBR sponge rubber, grey	± 50	Closed cell	GRAIL-9403-EN	Sealing, shock absorption	
	PVC/NBR sponge rubber, grey	± 50	Closed cell	GRAIL-9403-FR	Sealing, shock absorption	
PLASTIC FOAMS	Polyurethane foam, black	± 75	Open cell	GRAIL-PUR-FR	Sound insulation, shock absorption	Rolls, sheets, strips and gaskets
	Polyurethane foam, black	± 60	Open cell	GRAIL-PUR-EN	Sound insulation, shock absorption	
	PE foam, grey anthracite	± 30	Closed cell	GRAIL-0022-FR	Sealing, thermal insulation, thermo-compression	
	Melamine foam	± 10	Open cell	GRAIL-0702-FR	Sound insulation	

	MATERIAL TYPE	HARDNESS, SHORE A	COLOUR	PRODUCT REFERENCE	APPLICATIONS	END-PRODUCT TYPE
ELASTOMERS	EPDM	± 40	Black	GRAIL-1040-EN	Sealing, dampening	Profiles, strips, gaskets, moulded parts
	³EPDM	± 60	Black	GRAIL-1060-EN	Sealing, dampening	
	³EPDM	± 70	Black	GRAIL-1070-FR	Sealing, high and low T° applications, dampening	
	Neoprene	± 40	Black	GRAIL-1941-FR	Sealing, dampening	
	Neoprene	± 60	Black	GRAIL-FR-CR-65	Sealing, dampening	Sheets, strips, gaskets, moulded parts
	³Silicone	± 50	Grey or white	GRAIL-SI50-FR	Sealing, high and low T° applications, dampening	Profiles, strips, gaskets, moulded parts
	Silicone	± 50	Grey blue	GRAIL-SI50-EN	Sealing, high and low T° applications, dampening	Sheets, strips, gaskets, moulded parts
	Silicone	± 60	Beige	GRAIL-SI60-FR	Sealing, high and low T° applications, dampening	
	Silicone	± 60	Grey blue	GRAIL-SI60-EN	Sealing, high and low T° applications, dampening	
	Silicone	± 65	Dark grey	GRAIL-SI65-FR	Sealing, high and low T° applications, dampening	
	³Silicone	± 70	Grey or white	GRAIL-SI70-FR	Sealing, high and low T° applications, dampening	Profiles, strips, gaskets, moulded parts
	Silicone	± 75	Grey blue	GRAIL-SI75-EN	Sealing, high and low T° applications, dampening	Sheets, strips, gaskets, moulded parts

	RESIN	REINFORCEMENT	COLOUR	PRODUCT REFERENCE	PROPERTIES	END-PRODUCT TYPE		
COMPOSITES	Thermosets	Phenolic	Glass fiber cloth	Brown	GRAIL-WSPG3-FR	Excellent electrical insulation and mechanical properties. High fire and smoke rating.	Machined parts, moulded parts	
		Phenolic	Bakelite Paper	Light brown	GRAIL-PHCP-FR	Excellent electrical insulation at LV. Good mechanical properties. Punched parts.		
		Unsaturated polyester	Chopped glass fiber	Red	GRAIL-PGUTR-FR	Excellent electrical and thermal insulation properties up to 160°C. High tracking and arc resistance. High fire and smoke rating.		
		Unsaturated polyester	Glass mat	White	GRAIL-PGGM-FR	Excellent electrical and thermal insulation properties up to 155°C. High tracking and arc resistance. High fire and smoke rating.		
		Epoxy	Glass fiber cloth	Dark yellow	GRAIL-EPOGC-FR	Excellent mechanical properties. Good electrical insulation properties and high T° resistance.		
		Epoxy	Roving	Natural	GRAIL-EPORO-FR	Excellent mechanical and electrical insulation properties. High tracking and arc resistance. High T° resistance (180°C). Roving reinforcement.		
		Epoxy	Woven/non-woven	Beige	GRAIL-EPOWN-FR	Excellent electrical insulation properties. Good mechanical properties. High fire and smoke rating.		
		Epoxy	Polyester		GRAIL-EPOPE-FR	Good electrical insulation and mechanical properties. Good wear and tear resistance and excellent flexibility. High T° resistance (150°C).		
		Epoxy	Cotton cloth	Red	GRAIL-EPOCC-FR	Good mechanical and excellent electrical insulation properties. Excellent wear and tear properties. High flexibility. Low water absorption.		
		Silicone	Mica paper muscovite		GRAIL-SIPM-FR	Excellent electrical and thermal (450 to 800 °C) insulation properties. Good mechanical properties. High fire and smoke rating.		Machined parts, laminated sheets, rods.
	Silicone	Mica paper phlogopite		GRAIL-SIPP-FR	Excellent electrical and thermal (600°C) insulation properties. Good mechanical properties.	Machined parts, moulded parts		
	Silicone	Glass fiber cloth	White	GRAIL-SIGC-FR	Excellent thermal resistance (220°C). High tracking index and excellent dielectric properties in dry and humid environment.			
	Thermoplastics	Polyimide	Glass fiber cloth	Dark brown	GRAIL-PIGC301		Excellent thermal resistance (H insulator) and mechanical properties. Excellent resistance to solvents and dielectric liquids.	Machined parts, moulded parts
		Melamine	Glass fiber cloth	White	GRAIL-MEGC-FR		Very hard material with excellent water, chemical and flame resistance. Excellent electrical properties with high arc and tracking resistance.	Machined parts, sheets, rods and tubes
		Polyamide	Glass fiber cloth	Black	GRAIL-PAGF-FR		Excellent mechanical properties (high rigidity and compressive strength). Wide T° range from -20°C to +120°C. High heat deflection T°.	Sheets, machined parts
		Polycarbonate	Glass fiber cloth	Optical clarity (window grade)	GRAIL-PCGF-FR		Flame retardant, translucent polycarbonate chaged with glass fiber reinforcement for applications requiring higher stiffness.	
Elastomer		Aramid fiber	Green	GRAIL-BA-55	High fire and smoke rating. High T° resistance (270 °C continuous and 350 °C peak). Very good steam and chemical resistance.			

	MATERIAL TYPE	DENSITY (g/cm³)	COLOUR	PRODUCT REFERENCE	PROPERTIES	END-PRODUCT TYPE
THERMO-PLASTICS	Polyamide (PA)	1,17	Natural, black	GRAIL-PA6-EN	Halogen-free, flame-resistant, high strength and rigidity, low density grade	Extruded profiles, machined parts, moulded parts
	Polycarbonate (PC)	1,2	Transparent	GRAIL-POLYCARBONATE-FR	High optical clarity, high impact strength, T° from -100°C to +120°C	Machined parts, moulded parts
	Polypropylene (PP)	0,98	Natural, black (other colors on request)	GRAIL-PP-FR	Low impact, Flame-retardant PP	Injection moulding parts

	MATERIAL TYPE	DENSITY (kg/m³)	COLOUR	PRODUCT REFERENCE	APPLICATIONS	END-PRODUCT TYPE
SPECIAL MATERIALS	Woolen felt	± 200	Beige, black	GRAIL-L5FB	Sealing, shock absorption	Sheets, strips, cutted parts
	Woolen felt	± 300	Beige, black	GRAIL-L3FB	Sealing, shock absorption	
	³Non-woven PET	± 30	White	GRAIL-SOUND-EN	Thermal and sound insulation	Rolls, sheets, cutted parts

1 FIRE AND SMOKE ACCREDITATION ACCORDING TO THE INTERNATIONAL NORMS: EN 45-545, NF-F16-101, DIN 5510-2, BS 6853, UNI CEI 11170-3, ASTM C542/E662, UL-94, GOST...
 2 TO OBTAIN TECHNICAL DATA SHEETS AND/OR FIRE AND SMOKE CERTIFICATES FOR ANY OF THE ABOVE PRODUCTS, CONTACT US AT WWW.GRANDOGRUP.COM OR INFO-NIVELLES@BOYDCORP.COM

3 Extruded profiles with or without metal inserts.
 4 Non-exhaustive list of resin-reinforcement pairs.
 5 Non-woven PET with or without aluminium foil and/or with or without pressure-sensitive adhesive (PSA).

GRAIL PRODUCT RANGE **GRAIL** 产品系列

GRAIL-9032-EN **GRAIL-9923-EN** **GRAIL-SILCEL-EN** **GRAIL-9023-EN**

GRAIL-9404-EN **GRAIL-9401-FR** **GRAIL-9701-FR** **GRAIL-9403-EN**

GRAIL-9403-FR **GRAIL-PUR-FR** **GRAIL-PUR-EN** **GRAIL-0022-FR**

GRAIL-0702-FR **GRAIL** **GRAIL** **GRAIL**

GRAIL-1040-EN **GRAIL-1060-EN** **GRAIL-1070-FR** **GRAIL-1941-FR**

GRAIL-SI50-EN **GRAIL-SI60-FR** **GRAIL-SI70-EN** **GRAIL**

GRAIL-SOUND-EN **GRAIL-L5FB** **GRAIL-L3FB** **GRAIL**

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