



Making a **positive** difference



# Crestabond Adhesives and Crestapol Resins for Land Transport Applications

Feiplar Composites, 08 - 10 Nov 2016

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## ❑ ***Company introductions***

- Scott Bader and Novascott

## ❑ ***Introduction to MMA adhesives***

- What is an MMA adhesive?
- How does an MMA adhesive compare to other structural adhesives?

## ❑ ***Crestabond<sup>®</sup> Adhesives***

- Key features
- Application case studies

## ❑ ***Crestapol<sup>®</sup> Resins***

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**Scott Bader  
Company**



## **Scott Bader Headquarters Wollaston, UK**

**Over 65 Years of Reliability, Experience  
and Innovation in UPR Crystic® products**

- Over 90 years of heritage
- Totally independent, employee-owned company with no external shareholders and so being very stable
- Able to think and act long term as a business
- Colleagues fully involved in business direction and operation
- Establish & maintain long term partnerships with customers and suppliers
- Balance business needs with social, charitable and environmental obligations for sustainability
- High integrity, honest & trustworthy

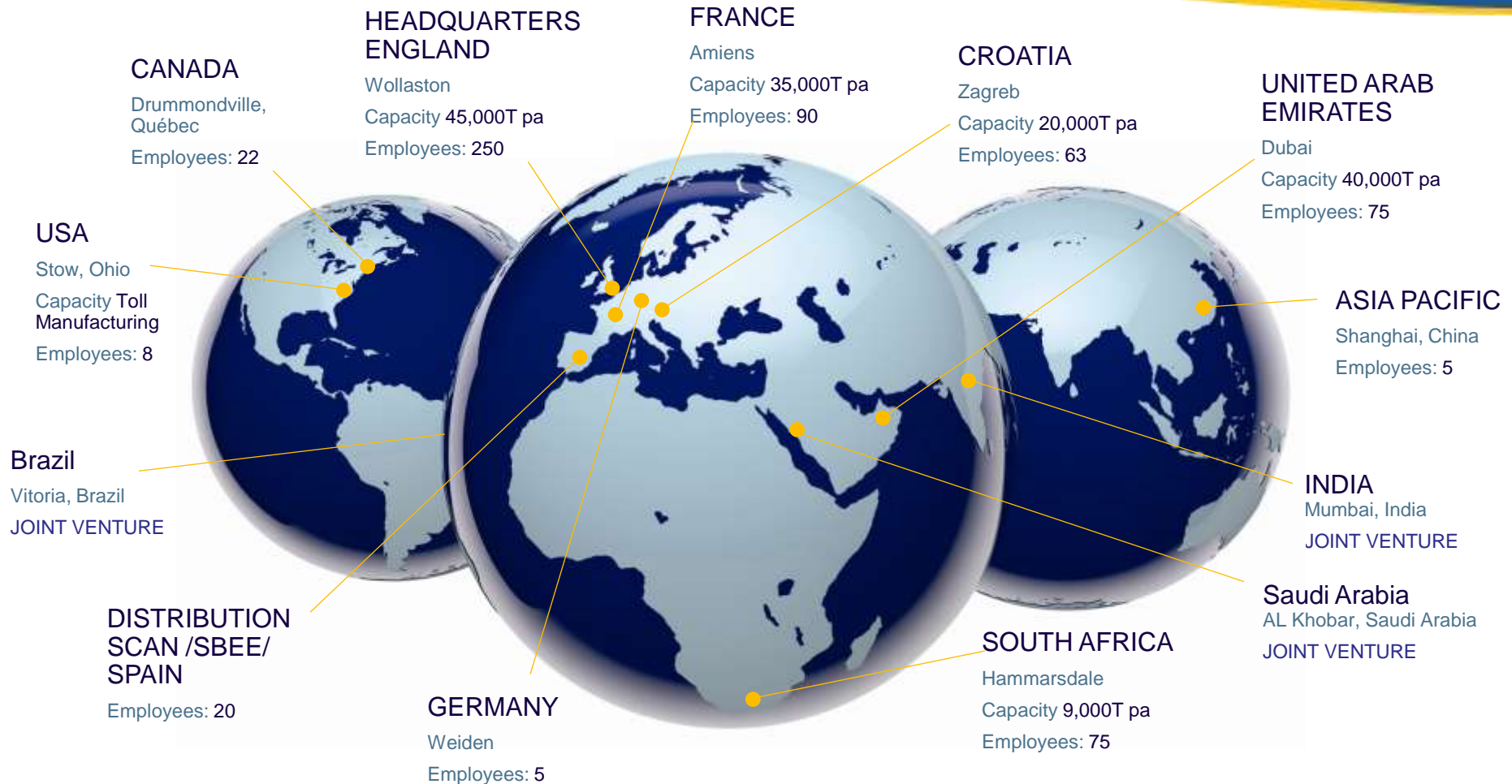


*“Innovation is at the heart of our company*



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# Production and R&D Locations



Scott Bader Group Turnover in 2015 was USD 250m [£188m]

- 50:50 Joint Venture company in Brasil between Scott Bader Company Limited and Andercol S.A. (Grupo Orbis)
- Established in 2014, offers a wide range of Scott Bader's speciality products in the Brazilian composites market:
  - **Crysitc® Gelcoats** (Marine, Wind Energy, Land Transport and Tooling)
  - **Crestomer®** and **Crestabond®** structural adhesives
  - **Crestapol®** high performance resins
- All the gelcoat products are produced in Brasil by Novascott and sold under the Crystic® brand under license from Scott Bader.

## ■ **Scott Bader Adhesives**

- More than 30 years experience
- Uses unique Urethane Acrylate technology

## ■ **Product range**

- **Bonding Pastes** for non-structural applications
- **Crestomers®** for structural bonding - GRP to GRP -
  - Revolutionised marine bonding
- **Crestabonds®** for multiple substrate bonding

## Crestabond® Adhesives



- ❑ **What is an MMA adhesive?**
  - Two component Methacrylate Adhesives (Activator & Adhesive)
  - Based on Acrylic technology
  - High performance, high strength
  - Room temperature cure
  - Reduce manufacturing time / cost
  - Range of cure speeds
  - Ability to bond dissimilar substrates
  - Alternative to Urethanes and Epoxies
  - 3 main groups of substrates to bond to:
    - **Metals, Composites & Plastics** -



## The 'big three'

Epoxy Adhesives	Methacrylates	Polyurethanes
Strong	← Versatile →	Flexible
Slow cure/post cure	← Control cure →	Generally slow cure
Surface preparation	← Minimal →	Surface preparation
Limited dissimilar Substrate bonding	← Variable →	Limited dissimilar substrate bonding
Structural	← Structural →	Non structural

## Key Features :

- **No primer required** on any substrates
- Minimal surface preparation needed
- Excellent fatigue and impact resistance
- Range of working and fixture times
- Good resistance to water, diesel and other common chemicals
- Good gap filling capability: 1mm – 50mm
- High elongation reducing stress on parts
- Service temperature from -40°C to +100°C
- Available in cartridges and in bulk



# Substrates MMA's Can & Can't Structurally Bond

## Can bond...

- Aluminium
- Stainless steel / Mild steel \*
- Coated metals, EPC, phosphotized, PPC, anodized, passivated
- Zinc / galvanised coated metals
- Polycarbonate
- ABS / PVC
- Acrylics
- DCPD (Telene & Metton), PDCPD \*
- Composites: UP, Epoxy, VE, Phenolic \*, Carbon
- Nylon 6 \*

\* M7 specifically developed to bond these materials

\* Preparation may be needed

## Can't bond...

- Polypropylene
- Polyethylene
- PTFE
- Butyl and rubbers
- Glass
- Wood
- Fabrics

## ■ Solomon Commercial

- Leading UK Manufacturer of Temperature Controlled Vehicles

Aluminium Corner Profiles



- Using Crestabond M1-30
  - Aluminium to GRP bond
  - Bulk and cartridges used
- Production Time saving
  - Reduced from 6 to 2 hours
- Cost Saving
  - Elimination of mechanical fixings

## ■ Far UK

- Novel carbon fibre & Crestapol® 1250 LV resin chassis
- Crestabond M1-20 adhesive
- Ambient temperature cure
- No need to postcure
- Low-cost
- High strength & tough joints





## ■ Transportation Bus Applications



One piece aluminium roof bonding



Body Panel Bonding.

Front and rear end caps, Roof profiles

## ■ Transportation Truck Applications



Stowage Lockers



Truck Cabs (Hoods, Fairing, Bumpers, Wheels arches, Wing mirrors, etc.)

## ■ Transportation Rail Applications



GRP front and rear end caps



Aluminium panels, Stainless Steel fittings



Internal Bonding (window surrounds, heating ducts floors, ceiling panels, light boxes)



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# Scott Bader Crestapol® resins High Performance Urethane Methacrylate Resin Technology

## Crestapol® Resins



- High performance Urethane Acrylate resins in styrene/ methyl methacrylate
- *Developed* from our tough Crestomer structural adhesives base polymers (25 years experience in house)
- Competitive against other fast turn around systems for RTM and Pultrusion
- Key markets: Land transport, Building and construction, Railway, Wind energy, Off shore....

## Five key features:

- Very fast cure
- Geltime from 2 - 60 minutes
- Tough resin matrix
- Very low viscosity leading to very high fire, smoke and toxic fume performance
- Excellent surface finish



## 1. *Open Mould*

- ✓ *Hand lamination*

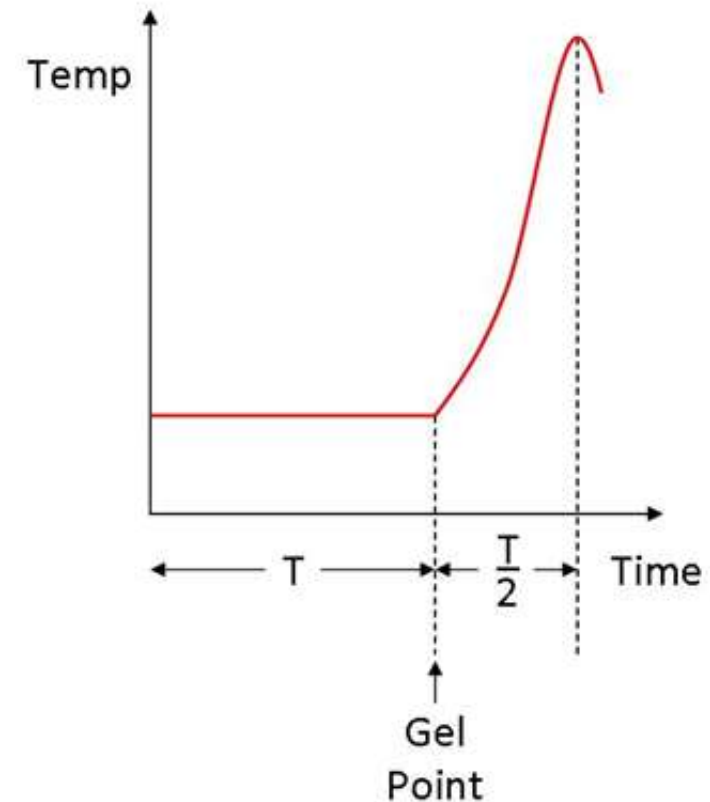
## 2. *Closed Mould*

- ✓ *Resin Transfer Moulding*
- ✓ *Resin Infusion*
- ✓ *Compression Moulding*

## 3. *Pultrusion*



- **Benefit 1 - fast cure**
  - High reactivity resins
  - 'Self accelerated' cure
  - From geltime to peak exotherm, ~5 - 10 minutes
  - After peak exotherm, resin is fully cured (no need for post cure)
  - Allows efficient, rapid manufacture of fully cured items
  - Compatible with PE gelcoats, Crestabond adhesives



- **Benefit 2 - wide range of geltimes**
  - Wide range of geltimes available depending on application (from seconds to 60 minutes)
  - BPO or Trigonox 44B cure system (depending on resin, GT, etc)
  - We work with individual customers to optimise system for their application

- **Benefit 3 - tough resin matrix**
  - Tough resin matrix + compatibility with reinforcement sizing gives excellent performance in end product (higher interlaminar shear strength, excellent fatigue resistance) with a range of reinforcements (glass, aramide, carbon fibre, etc)
  - Suitable for demanding, high impact applications

- **Benefit 4 - very low viscosity**
  - Very low viscosity allows a wide range of filler loadings, as well as excellent wet-out of glass reinforcing
  - Reduces cost, improves modulus (stiffness), reduces shrinkage
  - For general purpose applications, 30-50 phr  $\text{CaCO}_3$
  - For high performance Fire, Smoke and Toxic Fume performance, Alumina Trihydrate (ATH) can be incorporated up to 200 phr



- **Benefit 5 - excellent surface finish**
  - Very rapid cure allows excellent reproduction of mould surface cure
    - Before vapour pressure of monomer can effect interface
    - Negates effects of mould relaxation during curing

## Crestapol® Resins

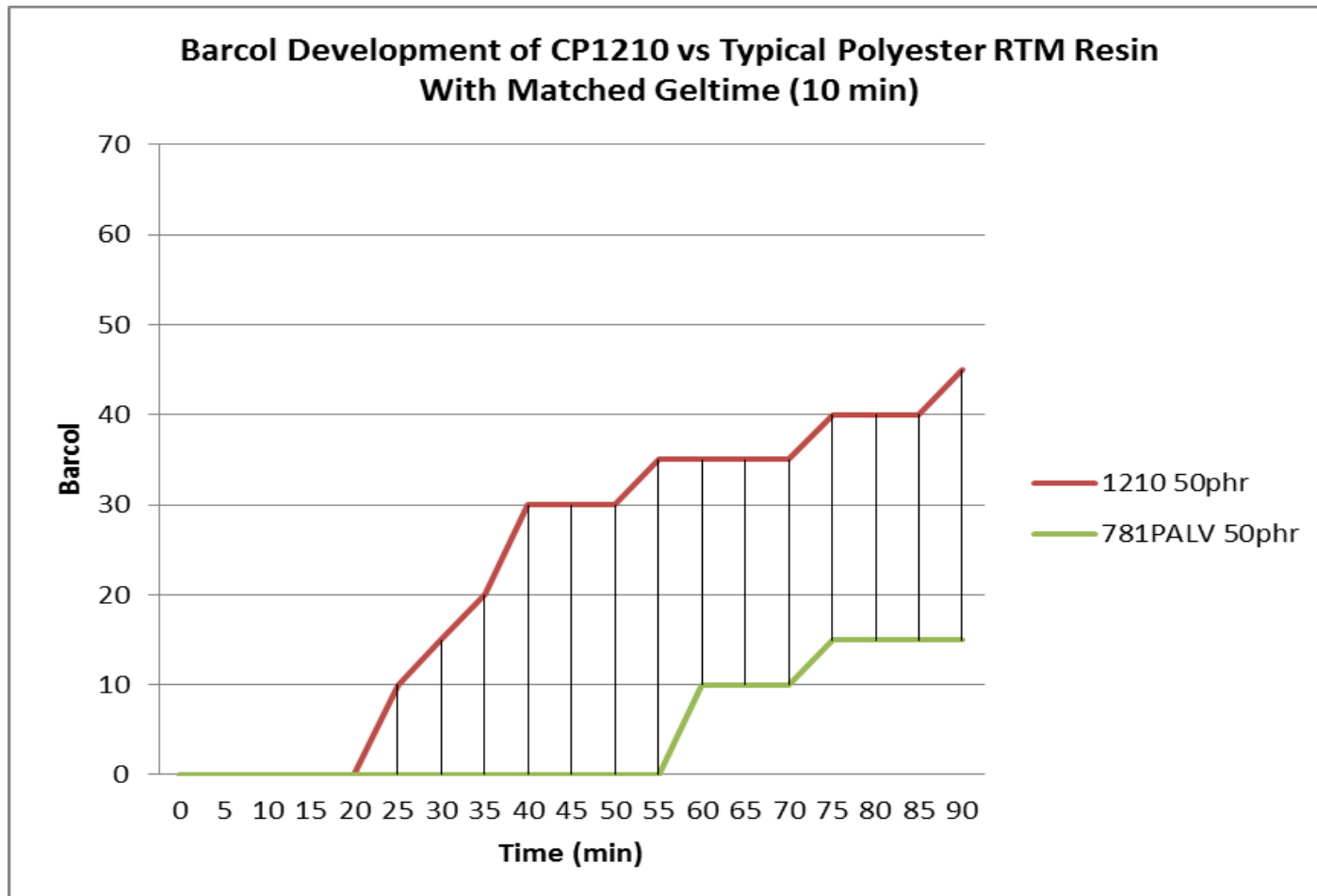
- Crestapol® 1210 & 1218
- Crestapol® 1212 & 1213A
- Crestapol® 1214
- Crestapol® 1250LV



## Crestapol® 1210 & 1218



- Tough, low viscosity, high reactive UA resin for closed mould applications (RTM/ LRTM)
- Very rapid demould (high throughput manufacturing)
- Can be filled as required for cost/surface finish benefits
- Mostly used in high volume RTM type applications where the rapid curing reduces cycle times and increases productivity
- Can be processed at ambient and high temperatures using composite and/or metal tooling
- Pre-filled & Pre-accelerated versions available -  
Crestapol® 1218 & 1218PA – Special grade of  $\text{CaCO}_3$  pre-added for cost/surface finish benefits



- New World Developments – Door skins using heavy RTM using heated metal tooling.





- Creative Composites – Car parts for Lotus using heavy RTM with heated metal tooling.



## Crestapol® 1212 & 1213A



- **High Performance Resins for highest fire, smoke & toxic fume (FST)**
  - Urethane Acrylate resin in styrene/methyl methacrylate
  - Tough, low viscosity resin for closed mould, infusion and pultrusion
  - Can be heavily filled with ATH for the very highest FST performance
  - High toughness for demanding applications
  - High quality tech support for formulation development, production trials, etc.
  - Pre-accelerated and Pre-filled version available - Crestapol® 1213A - for the very highest FST performance

# Crestapol® 1212 & 1213A Fire Hazard Levels - Applications

**HL1 = Tramway**



**Crestapol® 1212 & 1213A  
covers 90% of the rail  
market for FST applications**

Severity  
degree

**HL2 = TGV, TER, RER, Subway...**



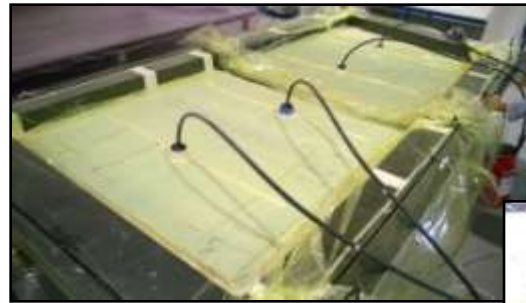
**90% of the market!**

**HL3 = Subway, tube, sleeping and couchettes cars**





- ✓ *Vacuum Infusion*
- ✓ *Compression Moulding*
- ✓ *Light RTM / RTM*
- ✓ *Hand Lamination*
- ✓ *Pultrusion*



- **Bangkok Subway** - Interior parts and chairs



*FR Standard:  
German DIN 5510,  
S4/SR2/ST2  
100phr ATH  
Resin Infusion*

- **Europe Train** - Carrier cover board



*FR Standard:  
French NFP 92-501  
M1 F2  
130phr ATH  
LRTM with balsa  
core/ PET foam*

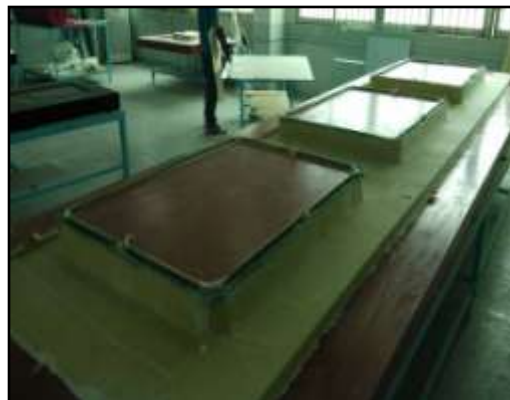


- **Brazil Railway - Checking door of electrical box**



*FR Standard:*  
*ASTM E166/E662*  
*120phr ATH*  
*HLU*

- **New Europe Train - The windows frame**



*FR Standard:*  
*EN45545*  
*HL2*  
*170phr ATH*  
*Resin Infusion*

## Crestapol® 1214



- Tough, low profile, low viscosity  
Pultrusion resin
  - Excellent surface finish
  - Crack-free thick section profiles
- Can be heavily filled with ATH for very high Fire, Smoke and Toxic Fume performance
- Typical applications threaded mine bolts, interior train panels, etc.

## Crestapol® 1250LV



- Low viscosity UA type resin developed specifically for producing high performance carbon fibre reinforced (CFRP) and glass fibre (GRP) parts by vacuum infusion, RTM or other closed mould processes.

- Cost effective alternative to epoxy infusion resin systems
- As easy to use as a typical UP resin, but when reinforced with CF can achieve a mechanical performance similar to, or higher, an equivalent CF epoxy resin laminate
- Room temperature cure using typical UP/VE catalysts
- Excellent surface finish with minimal fibre print through
- Excellent mechanical performance and durability
- Can be processed at room temperatures, needing only short periods of moderate post curing to achieve superior mechanical and high temperature performance
- Tg 130°C / HDT 109°C
- Compatible with CF and general purpose sizing agents





## ArianeTech

### Company Profile - ArianeTech Ingeniería, S.L.

**LOCATION : BARCELONA, SPAIN**

ArianeTech was first established in 2004 and today it is a leading engineering services company within the automotive, motorcycle and rail industries, specialising in the design and prototyping of motorcycles and scooters for a variety of high profile customers including Yamaha, Derbi and Rieju.

More recently ArianeTech produced the bikes for the Spanish Championship (Moto 3 and Moto 2).



### Crystic® Gelcoats and Crestapol Application

#### Crystic Gelcoat 253PA and Crestapol 1250LV

The parts were produced by Karbonius and the plugs and tools were manufactured by Skillful, LDA with a Rapid Tooling System.





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# Crestapol® 1250LV Customers/Applications

## Karbonius Composites



### Benefits/Advantages

#### CRESTAPOL® 1250LV

- ✓ Exceptional strength and durability
- ✓ Faster processability than rival epoxy products
- ✓ No need to post cure the parts, resulting in rapid cycle times
- ✓ Superb surface finish
- ✓ Excellent flow and fibre impregnation

#### CRESTABOND® M1 STRUCTURAL ADHESIVES RANGE

- ✓ Improved, more flexible assembly production
- ✓ Accurate adhesive application
- ✓ Minimal surface preparation
- ✓ Reduced assembly times
- ✓ Excellent surface finish

### Company Profile - Karbonius Composites

**LOCATION : LA CORUÑA, SPAIN**

Karbonius Composites is a leading rally car custom body parts fabricator located in Spain, with over 8 years' experience in composites.

Karbonius specialises in the design, manufacturing and repairing of all types of carbon fibre parts, carbon and Kevlar, as well as some fibreglass.



- Based on Acrylic technology, Crestabond® adhesives range is designed, developed and manufactured wholly by Scott Bader in the UK
- Allows high performance, high strength bondings between dissimilar substrates - **Metals, Composites & Plastics** -
- Crestabond® adhesives are **PRIMERLESS**
- Minimal surface preparation needed
- Excellent fatigue and impact resistance
- A genuine alternative to Urethanes and Epoxies

- Crestapol® Urethane Methacrylate resin technology allows a very broad range of balanced properties to be achieved
- Allows development of High Performance resins for niche, speciality applications :
  - Crestapol® 1210 & 1218
    - Very rapid demould for very high turn around
  - Crestapol® 1212 & 1213A
    - Achieves the very highest Fire, Smoke & Toxic fume performance
  - Crestapol® 1214
    - Tough, low profile resin for Pultrusion
  - Crestapol® 1250LV
    - Excellent mechanical properties & environmental resistance with Carbon Fibre, with low cost processing. A genuine alternative to epoxy resins

The Novascott Team are here to help:



**Juan Felipe Ruiz Z.**  
General Manager



**Rodrigo Briguelli**  
Technical  
Coordinator/Comercial



**Igor Salles Botti**  
Chemical Analyst

- With high quality products
- Technical support
- Processing and application knowledge
- And backed-up by Scott Bader experts

More information on these and other Scott  
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