GMT & GMTex®
well known – still innovative
Quadrant Group at a glance

**Business Field**
Specialty Plastics Materials (Polymer Conversion)

**Business Segments**
- High-Performance Plastics (QEPP / QCMS)
- Plastic Composites & Pipes (QPC / QCPS)

**Employees**
approx. 2’400

**Products**
High-Performance Thermoplastics (Semi-finished + Finished)

**Market Position**
Leading in all Areas of Activity

**Net Sales**
approx. CHF 750 million ~ EUR 690 million

**Global Presence**
Sites in all Major Industrialized Regions Worldwide (20 Countries)

**Accounting**
IFRS (since start in 1996)

**Shareholder**
Since 2013: 100 % Mitsubishi Plastics
Since 2017: 100 % Mitsubishi Chemicals Corp
Sites Worldwide – QPC Materials

Guelph, CA | SymaLITE®

Lotte, DE | SymaLITE®, GMT, GMTex®, MultiQ®

Changchun, CN | SymaLITE®

Nitra, SK | SymaLITE®, QTex

Lenzburg, CH | GMT, GMTex®

QPC Offices:
- Northville-MI, USA
- Chemnitz, DE
- Shanghai, CN
QPC material portfolio

Light weight materials
- SymaLITE®
- Synthetic- / glass fiber composite material, different area weights, tailored properties

Semi-Structural materials
- GMT
- Reinforcement with chopped & endless glass fibers, different additives

Structural Materials
- GMT-UD
- GMTex® / Organo sheets
- Glass fiber reinforcement unidirectional or as multilayer weaves

Sandwich materials
- MultiQ®
- Hybrid sandwich material SymaLITE® / GMTex®
History of GMT & GMTex®
→Continuous development process

- early 1970s introduction of GMT by Azdel in the US
- early 1980s granting of licenses to Japan and Switzerland (Symalit)
- early 1980s own patents by BASF in EU
- early 1980s introduction of UD-GMT for bumper beams
- late 1990s first version of GMTex (GMT + Twintex surface layers) for bumper beams
- 2003 new generation of GMTex with integrated GF-weaves for spare wheel pans
- 2006 introduction of QTex (organo sheet produced in continuous process) (QPC)
- 2007 introduction of high crystalline, low-warpage GMT (QPC)
- 2012 introduction of low-weight, high loft GMT (QPC-JP)
- 2013 introduction of PA6-GMT (QPC)
- 2017 introduction of FR-GMT (UL 94 V0) (QPC)
History of Quadrant‘s GMT & GMTex® business

- 1996  foundation of Quadrant
- 1996  acquisition of Symalit including their GMT business
- 1999  acquisition of the GMT business of BASF
- 2001  acquisition of the GMT activities of Borealis / Linz
- 2006  acquisition of the GMT business of JGC (Japan GMT Corp.)
GMT and GMTex® thermoplastic composites

**GMT** - glass mat reinforced panel
- Resin Matrix: Polypropylene (PP) or Polyamide (PA)
- Reinforcement: Long fiber 50 - 100 mm chopped or endless

**GMTex® / QTex Organosheet** - weave reinforced panels
- Resin Matrix: Polypropylene (PP) or Polyamide (PA)
- Reinforcement: Multilayer glass fiber weave technology

**Material combinations**
- Usage of high-performance GMT only
- Local reinforcement of GMT parts with GMTex® / QTex inlays
- Hybrid combinations
  - GMT, GMTex®, QTex, SymaLITE®, metal, div. thermoplastic composites, ...
GMT / GMTex® processing

- Compression molding process
- High pressure technology
- Different GMT / GMTex® grades in one part applicable
- Different wall thicknesses in one part feasible (2-25 mm)
- Weave technology without rework

Material combinations

- Usage of high-performance GMT only
- Local reinforcement of GMT parts with GMTex® / QTex inlays
- Hybrid designs
- GMT / GMTex® / QTex / SymaLITE® / metal / CFR

- Use the best material in the part area where it is most efficient
QMPS - Engineering services as bridge from QPC to OEM

**QPC**
Production of GMT / GMTex® & SymaLITE® Composite Materials
(Semi finished products)

**QMPS GmbH**
Design & Engineering
CAE Simulations
Prototyping & Tests for GMT/GMTex Parts

**Tier 1 & Moulder**
(QPC Customer)

**OEM**

Mercedes-Benz
BMW
Volkswagen
Audi
Porsche
Toyota
Ford
Quadrant Metal Plastic Solutions (QMPS)

Business Field
CAD & FEM simulation for GMT & GMTex®, CF-composites, LWRT, injection molded components & metal-plastic-hybrids

Customer
internal & external customers

Location
Chemnitz / Germany

Established
April 2008

Owned by
Quadrant Plastic Composites / Switzerland
QMPS engineering services

- Development of Light weight Solutions with Composites (particularly with GMT/GMTex®) and Composite-Metal Hybrid solutions
- CAD & Finite Element Simulations & Analysis (including Crash Simulations)
- Prototyping (tooling & molding)
- Testing & part evaluations
- Production process planning and process development

Front End
Mercedes SL
BR 231

Front End
Mercedes CLS
BR 218

Battery Tray
Mercedes S-Class
BR 222

Structural Engine Part
Porsche
Panamera
QMPS – Development & Support Process

1. Technical feasibility study (FEM)
2. Material specification (simulation)
3. Economic feasibility study (cost analyses)
4. Prototype development
5. Serial production (support before and after SOP)
QMPS – Tools & technical center

Tools
- CAD: CATIA V5 & Siemens NX
- CAE: Nastran / Patran (MSC), special translation to LS Dyna
- Material data cards for GMT & GMTex® (and other materials)
- Static simulation (temperature dependent)
- Dynamic simulation (temperature & speed dependent)
- Modal analyses

Technical Center
- Oven and hydraulic press
- Test equipment (tensile test machine, drop tower)
- Project specific test devices (developed by QMPS)
QMPS - Concept & feasibility study

- Simplified CAD part design aiming for max. function & part integration
- Simplified CAE model to analyze critical load cases
- Consideration of different material and basic design concepts
- Definition of demolding direction
- First estimation of potential weight saving, part performance and required materials
QMPS – Advanced development

- Detailed CAD part design in consideration of material characteristics and serial process capability
- Complex CAE model to analyze all mechanical requirements and load cases
- Definition of final material design
- Iterative optimization loops aiming for max. weight saving and best performance
- Final determination of weight saving, part performance and required materials
- First proposal of blank layout and process parameters
QMPS - Prototyping

- In-house development of PT-tools
- Verification of proposed blank layout
- Optimization of material handling and positioning in PT-tool
- Investigation of shrinkage and deformation behavior within the manufacturing process
- Determination of process parameters such as pressure, cooling time, etc.
- Important: The PT-process has to correspond to serial production process to greatest possible extent in order to obtain maximum correlation between PT-parts and later serial production parts.
QMPS - Testing

- Design of simplified pre-test scenarios targeting maximum correlation to more complex and expensive test methods specified by costumer or OEM
- Development and manufacturing of required test devices and accordant CAE-simulation of pre-test scenarios
- Comparison / verification of CAE-simulation results and test results
QMPS – Support of serial production

- Development of serial production concept in close cooperation with nominated molder
- Sharing prototyping results with nominated molder
- Support before and after SOP

Projected area: 416cm²
Press force: 75t
Component weight: 0.2kg
Thickness: 3mm
Material: X121F42
VW gas vehicle – Gas tank holder

Supply chain
OEM: Volkswagen AG
Tier 1: IMR Automotive S.p.A.
Material: GMT

Part information
- Needs to fulfil high dynamic loads
- Absorbs crash loads to prevent the gas tank from not being damaged.

Advantages
- Weight saving vs. the steel solution: ~ 50%
- Protection of the gas tanks against crash
Mercedes SLK R172 – Roll over bar

Supply chain
OEM      Mercedes Benz
Tier 1    Minda Schenk Plastic Solutions
Material  GMT / GMTex®

Part information
- First duplicate safety part in thermoplastic composites
- Rollover bar systems with integrated cross beam
- Integration of several functions

Advantages
- Functional integration:
  9 steel into 1 GMT / GMTex® part
- Weight saving 3 kg and cost saving compared steel
- High stiffness and dimensional stability
- High impact and mistreatment performance
- Recyclability
- Corrosion resistance
Mercedes S Class BR 222 – Battery tray

Supply chain
OEM        Mercedes Benz
Tier 1     Polytec
Material   GMT / GMTex®

Part information
- Fixation of batteries (at front-crash up to 50 g)

Features
- Weight saving vs. steel between 31 %...43 %
- Optimized operating structural durability and resonance frequency (NVH)
McLaren MP4-C12 - Front seat structure

Supply chain
OEM McLaren Automotive Ltd.
Tier 1 Polytec
Material GMT / GMTex®

Part information
- The safety part absorbs crash loads
- Anti submarine functions
- Integrated safety belt guides and fixation for textile and/or leather liners

Features
- Weight reduction (6.4 kg per part)
- Improved safety due to excellent material crash behavior
- High stiffness
Actros truck - Battery tray

Supply chain
OEM          Mercedes Benz
Tier 1       Polytec Composites NL B.V.
Material     GMT

Part information
- Weight saving compared to steel solution: 32 kg

Advantages
- Significant weight saving vs. steel (steel part 42 kg, GMT 10 kg)
- Steel box is made with 9 different single parts; GMT is one part molded by one press stroke
- High fatigue resistance
- High Function integration (1 GMT part vs. 9 steel parts)
- GMT tray carries 130 kg battery and 30 kg air tanks
- Air tanks are installed at the bottom of the battery tray
GMT vs. Steel

GMT carrier (10 kg weight)

→ produced by one press stroke

Steel carrier (42 kg weight)

→ 9 single steel parts
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Thank you for your attention