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New Lightweight Powertrain & Transmission Components

Vyncolit Engineering Polymers for Engine Performance Enhancements
Content

- Introduction: Group & Company Overview
- Trends in Powertrain & Engine development
- A piece of history: Pulleys & Idlers
- Clutch Piston
- NEW: Valve Block
- Future
Introduction: Group & company overview

**Vyncolit N.V.** group belongs to the vast subsidiary network of the Japanese group:

![Sumitomo Bakelite Co., Ltd.](image)

- Head Office, Tokyo
- Stock exchange, Tokyo
- Annual Consolidated Sales, JPY 255B (EUR 1.560 billion)
- Employees, 9,165 (worldwide)
- Subsidiary, 44 (Japan 16)

Figures as of March 31, 2007 (1,000 JPY = 6.122 EUR)
Vyncolit N.V. for more than 85 years

**Vyncolit N.V.**
- Head Office Gent (Bel.)
- Annual Sales:
  - EUR 35M / 13,000 tons
- Employees:
  - 135

Figures as of March 31, 2007

**History**
- **1924** - 1st plastic entity founded by Vynckier S.A.
- **1963** - 1st production of Engineering Glass Fiber Phenolic
- **1993** - Vyncolit N.V. created as a separate legal entity
- **1994** - Vyncolit N.V. acquired by Perstorp, a Swedish group.
- **2000** - Foundation of Vyncolit North America Inc.
- **2002** - Rogers MCD acquired as part of the strategy to become a global company

*New Lightweight Powertrain & Transmission Components*
Drivers:
- Engine downsizing
- Improving efficiency
- Reducing emissions
- Increasing reliability
- Driving comfort
- Increasing productivity with reduced costs

Trends:
- Turbocharging, direct injection, EGR systems in Diesel and Gasoline engines
- Hybrid, H₂ Engines
- Multi Gear Transmissions, DCT & CVT
- Weight reductions through Metal-Thermoset/Thermoplastic conversion and design optimization
- Bio Fuels and Bio Diesel
Drivers & Trends in Engine, Powertrain & Transmission Development

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Trends
- Turbocharging, direct injection, and Diesel and Gasoline engines
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Temperature Increase Under the Hood

Design Challenges

Cost Reductions

Weight Reductions

Please see important disclaimer as stated on slide 1

New Lightweight Powertrain & Transmission Components
Vyncolit® Phenolic Engineering Polymers

Vyncolit®
Phenolic Engineering polymers
With Glass Fiber as main reinforcement, these materials give very high mechanical and thermal properties. The high degree of pourability and plasticity makes them especially suitable for molding complicated parts.
This family is divided in five main series

Properties to Note:
- High **mechanical strength**, even in thin sections
- Excellent **dimensional stability**
- Very good **electrical insulation**
- Good **resistance** to automotive chemicals
- Excellent **temperature resistance**
- Excellent **creep resistance**
- Very **low CTE**
1992: Development of specific materials for Pulleys, with approval from BMW.

1993: First industrial production of Alternator Pulley

As from 1993: Valeo, Hutchinson & Denso have been using Vyncolit Materials for alternator, air conditioning, steering pump, waterpump Pulleys.
Clutch Pistons

New Lightweight Powertrain & Transmission Components
Clutch Pistons: Parts description

- Material: Vyncolit X655/X680
- Molder: K & E
- Tier I: ZF Sachs, LuK
- OEM: VW, Audi
- Models:
  - Audi A3
  - VW Golf V

New Lightweight Powertrain & Transmission Components
Clutch Pistons Properties

- Integrated Magnetic Sensor (positional detection) prevented the use of steel pistons
- Compared to steel-alu versions, the Thermoset Piston achieved higher efficiency, reduced NVH, weight reduction and high durability

- Due to the material properties the Pistons:
  - have a highly polished surface: the glass fibers are perfectly incorporated into the resin matrix
  - are dimensional stable due to the low Coefficient of Thermal Expansion
  - maintain their properties even at higher temperatures and in contact with hydraulic oils & chemicals.
Clutch Piston Material Properties
Reduced Noise, Vibration & Harshness

Steel-Alu Pistons

Vyncolit Pistons

Reduced Noise, Vibration & Harshness

No Slip-Stick
Permanent Low Friction

actuation speed

actuation speed

Source: LuK

New Lightweight Powertrain & Transmission Components
Other Clutch Pistons

Clutch Master Cylinder: LuK

Variable Master Cylinder: LuK

Please see important disclaimer as stated on slide 1

New Lightweight Powertrain & Transmission Components
Valve Block DCT

New Lightweight Powertrain & Transmission Components
The Valve block:
- Material: Vyncolit X6952
- Molder: Baumgarten
- Tier: Hilite International
- OEM: VW’s next generation DCT’s: DQ200
Valve Block Function

- Identical Valve Blocks for each sub-transmission: one part number for both valve blocks
- High system pressure and small actuators possible
- Valve Block Design:
  - 1 Proportional pressure reducing Valve
  - 3 Proportional Flow Valves
  - Each block has 1 supply pressure in-port & 3 out-ports for shift and clutch actuators

Source: CTI Transmission Symposium
The control unit of VW’s new DCT

New Lightweight Powertrain & Transmission Components
Valve Block Thermoset: Material Advantages

- Heat, pressure and chemical resistance of the material, Vyncolit X6952
- This complex part can be made through injection molding without after machining
- Design freedom for compact & complex parts
- Weight reduction: 60 gr for each part = 120 gr reduction in total compared to Alu part
- Cost Reduction (15 %) Thermoset part versus Aluminum part: Simplified design, no after machining
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Dimensional Stability

- Excellent Dimensional Stability at elevated temperatures (150°C) combined with high pressures (up to 60 bars) in hydraulic fluids
- Tight dimensional tolerances
- The Coefficient of Thermal Expansion and the tight manufacturing tolerances of the material allowed the use of O-ring sealings.
- The smooth surface finish protects against wear to the sealings: no glass fibers at the surface
Chemical Resistance in Transmission Oil

Test specimens: MPTS bars according to ISO 3167, post-cured up to 180°C
1 Pentosin CHF 202 is a Deutsche Pentosin Werke GmbH product

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New Lightweight Powertrain & Transmission Components
The Valve Block is bolted directly to the hydraulic control unit with the aid of positioning pins. These 5 bolts induce each a static load of max 50 MPa onto the part.
Stability under load at High Temperature

Tensile Creep @120°C (load 50 MPa)

Test specimens: MPTS bars according to ISO 3167, post-cured up to 180°C
Please see important disclaimer as stated on slide 1

New Lightweight Powertrain & Transmission Components
Future Developments

**Air Systems: Turbochargers & EGR:**
- Developed: Plastic Turbohousing (Cold Side):
  - Coorporation with Woco for IHI – Daimler
- Under development:
  - other turbocharger parts such as compressor wheels
  - EGR Module (extra high heat resistance up to 450°C)

**Pumps:**
- Oil Pumps:
  - Developed:
    - Schieber Variable Oil Pump
  - Under development:
    - other oil pump parts such as gears, spurs, housings
- High Pressure pumps
  - Under development
Thank you for your attention

For further information...
Please visit our website at
http://www.vyncolit.com

Polymers for Performance!