

# MAKE IT QUICK!

HIGH-PERFORMANCE DCPD-BASED FORMULATIONS FOR PROTOTYPING CAN ENABLE RECORD-BREAKING TIME-TO-MARKET TIMEFRAMES FOR OFF-HIGHWAY VEHICLES, WHILE WITHSTANDING HOSTILE HANDLING AND ENVIRONMENTS

▶ A registered trademark of the Rimtec Corporation, Telene is a dicyclopentadiene (DCPD) formulated resins system which, when converted by the reaction injection moulding (RIM) process, results in pDCPD, a high-performance polymer. Its process and properties enable the formation of large to very large complex-design parts that are resistant to hostile handling and harsh environments. Being cost effective for small to medium series production, this polymer has naturally found its fans within the agriculture and construction equipment market segments, as well as the engineering departments of global OEMs.

Telene SAS has recently developed a whole new family of high-performance DCPD-based formulations. Similar to the current RIM grades 1600 and 1700 series, the new Telene 1800 series consists of a two-component system (mixing ratio 1:1), using the same monomers, but is based on a different catalytic system that is not sensitive to oxygen contamination and allows the use of non-heated moulding tools. Among other applications, these new grades have successfully entered the off-highway body panels prototyping industry.

Indeed, due to their low viscosity and highly adjustable curing time, Telene 1810 and 1811, the first two commercially available grades, provide ease and flexibility in the production method, from simple hand pouring to low-pressure machine casting. As the mechanical and thermal properties of the final polymer are similar to those of the traditional RIM products, the 1800 grades enable the production of 'actual properties' Telene pDCPD.

## The right tools for the job

"Even though a quarter to a third of all off-highway vehicles produced in Europe already feature at least one pDCPD part, there is still a lot of room for growth within our core market, and convincing work based on pragmatic experimentation is still to be done," says Gilles Recher, technology manager at Telene SAS. "Yet, design engineers demand to test pDCPD, for example, for metal replacement solutions or Tier 4 hood solutions, without having to pay for final, aluminium-made production tooling.

"So we designed a no-frills formulation that allows Telene converters to deliver demonstrators by casting in non-heated, low-





LEFT: Hidromek's Maestro show model at Bauma featured its serial pDCPD fenders and cabin fittings

cost tools. For those OEMs who are new to pDCPD and do not have any established ties with converters, our brand-new tech centre located near Lille in the north of France, or some experienced prototyping studios, can support their project, in the comfort of an off-production line setting."

ED Design from Turku, Finland, is one of the latter. Matti Makkonen, a project engineer at the company, has developed several Telene prototypes for AGCO, and reports his exchange with his customer, Kimmo Wihinen, design manager at Valtra: "The simple reason for this is that we wanted the prototype hood to mimic production hoods as closely as possible – particularly from the standpoint of material properties. Earlier, we used mostly glass fibre for prototype hood material, but this did not work out well because of issues such as how they reacted to different ambient temperatures. New engine emission requirements mean that temperatures underneath the hood will rise, and therefore testing the material behaviours and hood behaviours in higher temperatures is really important.

"Another reason for using Telene 1800 as the prototype material is the B-surfaces. Earlier, when we used mostly glass-fibre materials for prototype hoods, the A-surfaces turned out well when they were made with single-side moulds, but the B-surfaces and material thickness were not acceptable. Now when using Telene 1800 we can also make the B-surfaces just as they are in 3D models in the prototype stage, and we get more accurate feedback from that side too – such as if some parts are touching the hood, how the air flows in inner surfaces of it, how the air exhaust ports work in real life and so on.

"Also, when the prototype production method is the same as in serial products, we can get some feedback about possible sink marks and make changes to design before ordering serial production moulds."

### Proven prototypes

Several on- and off-highway vehicle OEMs have repeatedly requested Telene 1800-made prototypes either for long-term field tests or for dealer network presentations of upcoming

Prototype hoods from the new Valtra N4 series were produced using Telene 1810



models or existing vehicle improvement projects. This has allowed them to present vehicle prototypes that already feature key elements of Telene DCPD high-performance formulations such as high quality, a paintable surface finish, the ability to mould large and complex parts weighing 15kg or more, highly three-dimensional parts, and over-moulding of inserts. All of this without compromising on the properties those off-highway OEMs like most: impact resistance, and resistance to hot and very cold temperatures, corrosive and abrasive environments.

From a practical standpoint, the Telene 1800 series offers the possibility to either

mould accurate geometry or cast near-net shapes that will be machined and/or finished afterwards. Options for tooling material were carefully scanned at Telene's European tech centre. The key points of this screening were:

- To check the heat resistance of the material or, by default, treatment against the exothermic peak of the reaction (180°C);
- To evaluate hardness and resistance against shrinkage;
- To minimise the porosity of mould material, (which would have a detrimental effect, due to the low viscosity of the injected formulation);
- To gauge the influence of the part geometry and its complexity play on how quickly the



tool surface evolution would compromise the A-side's acceptability.

For each prototype part project, besides budget allowance, the choice will depend on a variety of factors – the main ones being part size and complexity, number of prototypes needed and surface quality requirement. So far, the following materials have been successfully used: epoxy impregnated wood (MDF), gel-coated glass fibres, reinforced composite either based on vinyl ester or epoxy matrix, and machinable board. Tools can be kept fairly simple as no thermal regulation is required.

As head of innovation management at Wayand, Germany, Rebecca Ebermann-Finken

## Technical data sheet for Telene 1810

This system has been designed to produce machine cast parts having similar properties as Telene 1650 production parts

Properties	Standard N°	Unit	Data
Specific gravity	ISO 1183	n.a	1.03
Tensile modulus	ISO 527	MPa	1700
Tensile strength @ yield	ISO 527	MPa	44
Elongation @ yield	ISO 527	%	5.0
Flexural strength	ISO 178	MPa	61
Flexural modulus	ISO 178	MPa	1700
Impact strength (notched izod) @ +23°C	ISO 180/A	KJ/m <sup>2</sup>	30
Glass transition temperature	ASTM D790	°C	169
Heat distortion temperature (under 1.8 MPa load)	ISO 75/A–Tfe 1.8	°C	120
Linear thermal expansion	ASTM D696	m/m/°C	79x10 <sup>-6</sup>
<b>Processing Parameters</b>			
Mixing ratio	n.a	n.a	1:1
Smoke time @ 30°C	Method 4	Sec	600*
Initial viscosity @ 30°C A & B component	Brookfield	mPa.s	260
Exotherm temperature	Method 4	°C	> 180°C

\* Slower/faster formulation on demand

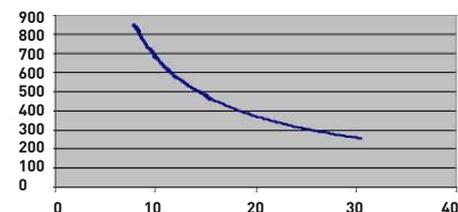
TOP AND ABOVE: Views of the A- and B-surfaces of CNH's new telehandler hood – prototyped and commissioned in just a few weeks using pDCPD

(Pictures: Polirim srl & CNH)

ABOVE RIGHT: The B-side of 1800 prototype parts can be moulded exactly as per original CAD file (Picture: ED Design)

ABOVE FAR RIGHT: Off-line production of an over-the-road vehicle prototype (Picture: Wayand AG)

BELOW: Telene 1810 viscosity vs temperature test showed the viscosity of Telene 1810 A and B remains stable during shelf life





confirms the above: “We had a very busy production period when one of our bus and truck OEMs asked us to produce prototypes made from Telene. Its time constraints were very tight, while, on our side, disrupting production to mould these parts would have been a true headache at that particular time. Using Telene 1810 prototype grade allowed us to deliver within timeframe, from an MDF tool and without using RIM machine time, and using low clamping force equipment.”

In addition, shorter time to market has been demonstrated. Several Telene moulders have managed to produce functional prototypes that OEMs or final customers could evaluate in a short time, not only enabling but also speeding up the final decision in concluding whether pDCPD was the material of choice. This was

demonstrated at CNH in Italy, who confirmed in just a few weeks its desire to use Telene for a new hood, including a rather complex, single-piece omega reinforcement part.

Gianni Santarcangelo, CNH’s telehandler chief engineer, indicates that the exercise has been positive for the OEM’s new model: “We have been able to carry out a lot of vehicle trials with a prototype already using final material, as well as clear our questions related to gaps between the hood and the engine components, which were quite low in some areas, and in an easier way than with prototypes made from glass-fibre composite.”

But the fastest-ever prototyping job with the 1800 series was carried out by Sazcilar, a composites manufacturer based in Bursa, Turkey. Its team of engineers and technicians

presented a set of finished painted fenders and cabin facing parts to its customer, Hidromek, in just 48 hours, with no previous experience of the 1800 series.

“Telene 1800 casting grade is a very easy-to-process material and, just by using existing RTM moulds, we could supply our customer with actual material pDCPD parts just in time for Bauma 2013,” says Eray Türkyilmaz, head of strategy planning and business development.

“Telene 1800 kept all of its promises: demonstrating future part performance at low cost, speed and simplicity.” **IVT**

*Ralph Hédél is sales and marketing manager at Telene*

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