

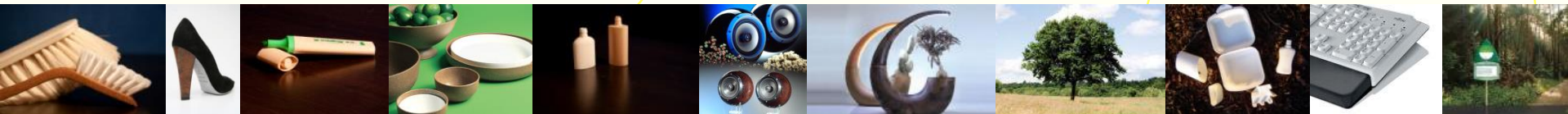


Biopolymertrends – Applications and New Developments

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Tecnaro GmbH



Who we are

TECNARO GmbH was founded in 1998 as a spin-off of the Fraunhofer-society.

TECNARO develops, produces and markets high-quality **thermoplastic materials** based on **renewable materials** for the plastic processing industry.

Additionally, we develop customized compounds and provide competitive compounding services.



● 1998

Foundation of TECNARO as Spin-Off off the Fraunhofer-Institut Chemische Technologie (ICT) Pfinztal

● 2000

Relocation of the head office from Pfinztal in Baden-Württemberg to Thüringen into the Founder and Innovationcenter Eisenach/Stedtfeld

● 2006

Return to Baden-Württemberg and acquisition of the new locations in Ilsfeld-Auenstein

First application of ARBOFORM® in automotive

● 2008

Growth in Scale despite Crisis, Project ARBOCAR
Despite worldwide economic crisis growth in scale of 40%.

Projekt leader of ARBOCAR for the development of a natural material based on Lignin for vehicle interiors

● 2010

16. successful Patent Application, European Inventor Award
Continuous R&D, steady advancements of the established compounds leading to 16. patent.

Achievements awarded through the European Patent Office: European Inventor Award.

● 2011

Further Cooperations, Diesel Award
Supply contracts with Braskem and Henkel.

Winning the Diesel Award in the Category „Sustainable Innovation“ through the German Institut of Development (DIE).

Why should I chose TECNARO?



ADVANTAGES of BIOPOLYMERS

Materials based on renewable resources with interesting sustainable properties, such as

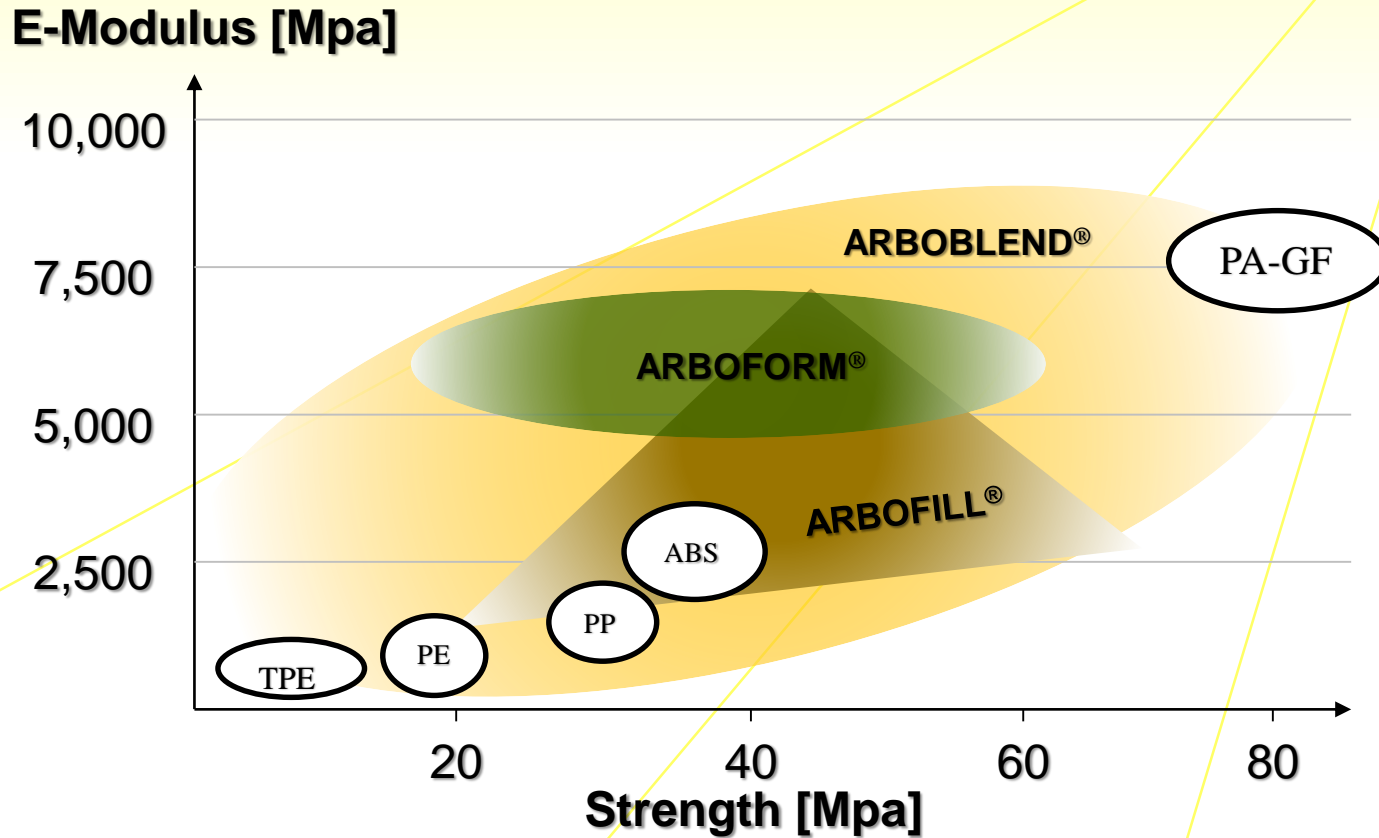
- Complete CO₂ – cycle
- Conservation of limited resources
- Alternative market for agricultural products
- Usage of natural synthesis
- New end-of-life options: biodegradation or energy recovery (CO₂-neutral)
- Substitution of limited crude oil resources

Your Additional Advantages to Conventional Polymers

- Finished parts, substituting conventional oil-based plastics
- Finished „wooden“ parts with 3D – design possible
- Extension for new design options for wood-like products

OUR SERVICE FOR YOU

- Involved in business since 1998
- Product development according to material requirements
- Customized compounds
- Standardized converting technologies
- Lab for material testing
- Individual guidance
- Flexible and fast competence on innovations



Material Overview

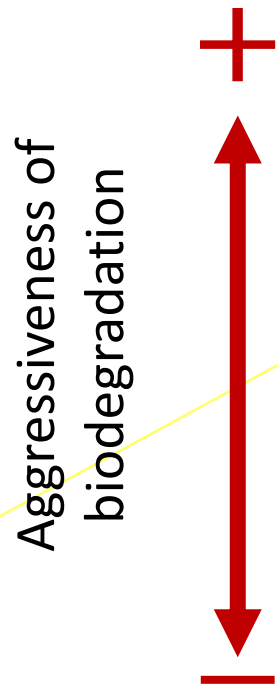


	ARBOFORM®	ARBOBLEND®	ARBOFILL®
Types	F45, LV3, LV4, LV100	Compound families D / M / V / X <i>(see slide 15 for further details)</i>	Pine, Beech, Coir
Compound components	Lignin, Natural Fibers, Natural Waxes and Additives	Polyhydroxialkanoate, Polycaprolactone, Polyester, Ingeo™, Lignin, Starch, Cellulose, Organic Additives, Minerals, natural Waxes and Fibers	Hybrid of conventional plastics and renewable resources
Content of Renewables	100 %	Up to 100 %	30 – 80 %
Biodegradable	Yes	depends on type	No
Colouring possible	(Yes)	Yes	Yes
Processing options	Injection moulding, extrusion, melt spinning, calandring, blow moulding, thermoforming or compression moulding into moulded parts, semi-finished product, sheets, films or profiles.* *depends on grade.		

Overview on existing standard grades of TECNARO.
Customized compounds may differ from the above named details.



Classification of biodegradation



Environment	Conditions		Standards (examples)
Industrial Compost	High temperature	Bacteria & fungi	EN 13432 „seedling“
Home Compost	Ambient temperature	Bacteria & fungi	AS 5810
Soil	Ambient temperature	Bacteria & fungi	EN 17033
Fresh water	Ambient temperature	Bacteria	ISO 9408
Marine water	Ambient temperature	Diluted bacteria	ASTM D 6691



Material Overview: ARBOFORM®



ARBOFORM® is based on the almost endless available but nowadays rarely used renewable resource Lignin, natural additives and natural fibers. The basic material **ARBOFORM®** is multiple awarded and is also known as „Liquid Wood“.

ARBOFORM® does not lose its wood-like characteristics after converting. This offers new options for example in the music industries.

ARBOFORM® is made out of 100% renewable resources and is completely biodegradable.

Applications

European Inventor Award



After TECNARO was the winner of the European Inventor Award 2010, the European Inventor Award trophy a year after was made out of ARBOFORM® (in 2011).

Romolo Stanco's Green Lamp



Low shrinkage allows to produce geometries with different wall thicknesses (even thin to thick).

Picture: <http://interspacedesign.files.wordpress.com/2011/02/romolostancogreenlamp1.jpg>

Designer shoes



Eco Pump from Sergio Rossi, Gucci Group: High heel made from ARBOFORM® F, Sole and packaging made from ARBOBLEND®.

Picture: Sergio Rossi, Gucci Group, Italy

Applications

WOOD WATCH



Undercut for the bracelet pins become demoldable through suitable tool technologies.

Picture: Fraunhofer

Urns made by injection moulding



Urns made from ARBOFORM® (=Liquid wood) which can biodegrade harmlessly in forest areas.

Picture : Homepage Friedwald GmbH

Toys



Material selection between genuine and liquid wood according to item geometry.

Picture: toy producer

Applications



Acoustics



Injection moulding of ARBOFORM® enables root-wood appearance and acoustical properties comparable to hard wood with less moisture absorption.

High-End-Class 2.1.-HiFi-Solution made from ARBOFORM®

Picture: Sonissimo Soundmanufaktur. IMM Holding GmbH

Thin Wall Injection Moulding



Thin wall injection moulding or rather long flow paths are possible through optimized grades.

Eco-Keypad from Fujitsu. Leader in Green IT: Palm rest made from ARBOFORM® injected at Amper Plastik.

Picture: Fujitsu

Carbon Parts



Injection moulding of ARBOFORM® with subsequent pyrolyzation results to pure carbon parts (99,9% concentration) with interesting electric conductivity properties and high dimensional stability under heat.

Applications



IML with wood veneer to seamless fitting tarsia



Low shrinkage leads to minor distortion, allowing to produce back injection moulded components with real wood veneer and other decors like brushed aluminium.

Natural Surface



The use of a special granulation procedure for ARBOFORM® F results a natural surface appearance. Steering wheel segment with varnished ARBOFORM® surface

Technical Components



Low shrinkage qualifies ARBOFORM® for very precise items where tight tolerances are required. Injection moulded 12 H7 fit (toleranz 0,018 mm)

Material Overview: **ARBOBLEND®**



ARBOBLEND® is a mixture of different biopolymers like PHB, PLA, lignin, starch, natural resins and waxes, cellulose, Green-PE, Bio-PA and additives.

ARBOBLEND® can be used in several thermoplastic technologies. It is – depending on the composition – fully biodegradable.

Applications

**ARBOBLEND®
Grades with
Green PE**



Large-scale productions in parts of toys (f.e. frisbees), office products, packaging etc.

Picture: New Games

**Extruded and
Thermoformed
ARBOBLEND®
sheets**



Forest signs in Bavarian State Forest made of wood fiber reinforced ARBOBLEND®.

Picture: Jochen Rümmelein

**Prizewinning
Materials and
Products**



Multifunctional bio materials with uniform, bright surface for injection moulding and melt spinning.

Picture: Proganic

Applications

Film Extrusion



Variation of film properties concerning biodegradation, barrier properties, flexibility, gloss level, noise development, stretchability, etc.

Picture: Lifocolor

Melt Spinning of Filaments



Special ARBOBLEND® grades can be processed by melt spinning to filaments with different titers.

Thermo- forming



Application potentials can be developed in Agrotextiles, Hygiene, household, packaging etc.

ARBOBLEND® - overview on properties



Compound family	D	M	V	X
Characteristic properties	High impact strength, high heat resistance	Stiff to plastized-PVC property portfolio	Different properties from PP via HIPS to ABS possible	Properties comparable to PP / PE
Biobased content	Up to 100 %	Up to 100 %	Up to 100 %	Up to 95 %
Food contact possible	Yes	Yes	Yes	Yes
Adhesion	Good	Good	Good	Fair
Scratch resistance	Good	Good	Good	Fair
Natural Colour	Translucent to beige-white	White	Transparent to white	Translucent to white
Biodegradable	No	Yes	Yes	No
Processability	Injection moulding	Injection moulding, extrusion	Injection moulding, extrusion, melt spinning	Injection moulding, extrusion, melt spinning, blow moulding

ARBOFILL®

Material Overview: ARBOFILL®



ARBOFILL® is a premium compound of polymers and natural fibers with a natural, wood-like appearance. These are specially tested on food packaging and dishwashing.

Because of the excellent behaviour converting **ARBOFILL®**, our customers produce far more environmentally friendly at a lower energy level compared to commodity plastics.

Applications



Pens



Edding 24 Highlighter: cap and barrel consists of ARBOFILL® with 70% renewable resources.

Picture: Edding

Office Products



Injection moulded products with natural fiber reinforced polymer show good surface characteristics.

Picture: COZA

Office Chair



The salida chair of the Samas brand Drabert with a backrest made of an innovative biomaterial from Tecnaro GmbH.

Picture: Samas

Applications



Housewares



COZA produces more than 40 household products of ARBOFILL®.

Picture: COZA

Household Products



Injection moulding of integral hinges with natural fiber reinforced ARBOFILL®.

Picture: Rotho

Extrusion of Profiles



Extrusion of profiles, e.g. different baseboards.

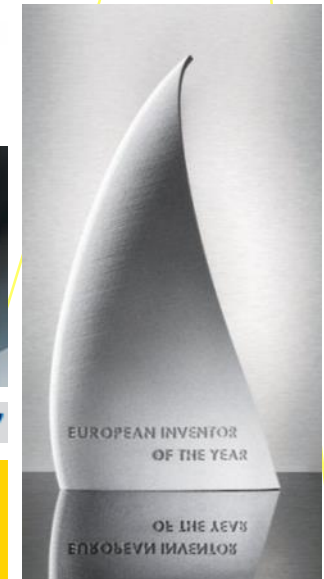
Awards



- Green Brands Award 2013
- Diesel Award 2011
- European Inventor Award 2010
- German Industry Award 2009
- Werkbund Label 2008
- VR Innovation Award 2007
- Material ConneXion, NY 2002
- MDR 1st Place „Einfach genial“
- ZDF Show „WiSO“, 1st Place
- EuroMold Award in Gold, 2000



VR-InnovationsPreis Mittelstand 2007



15 patent families

TECNARO GmbH

Thank you very much für your interest!



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For any further questions, please do not hesitate to contact us.

