Biopolymertrends – Applications and New Developments

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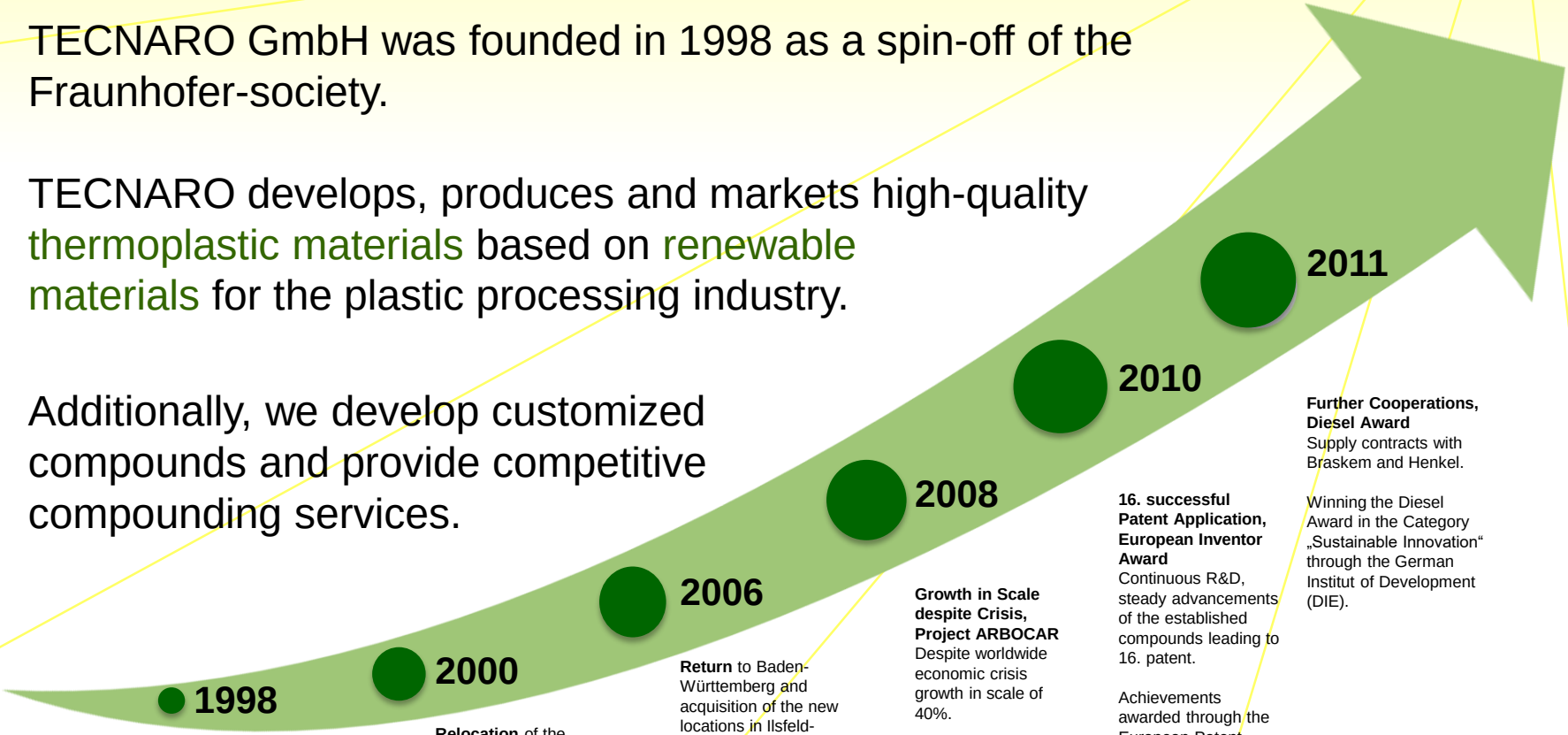
Tecnaro GmbH

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.



Why should I chose TECNARO?

ADVANTAGES of BIOPOLYMERS

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

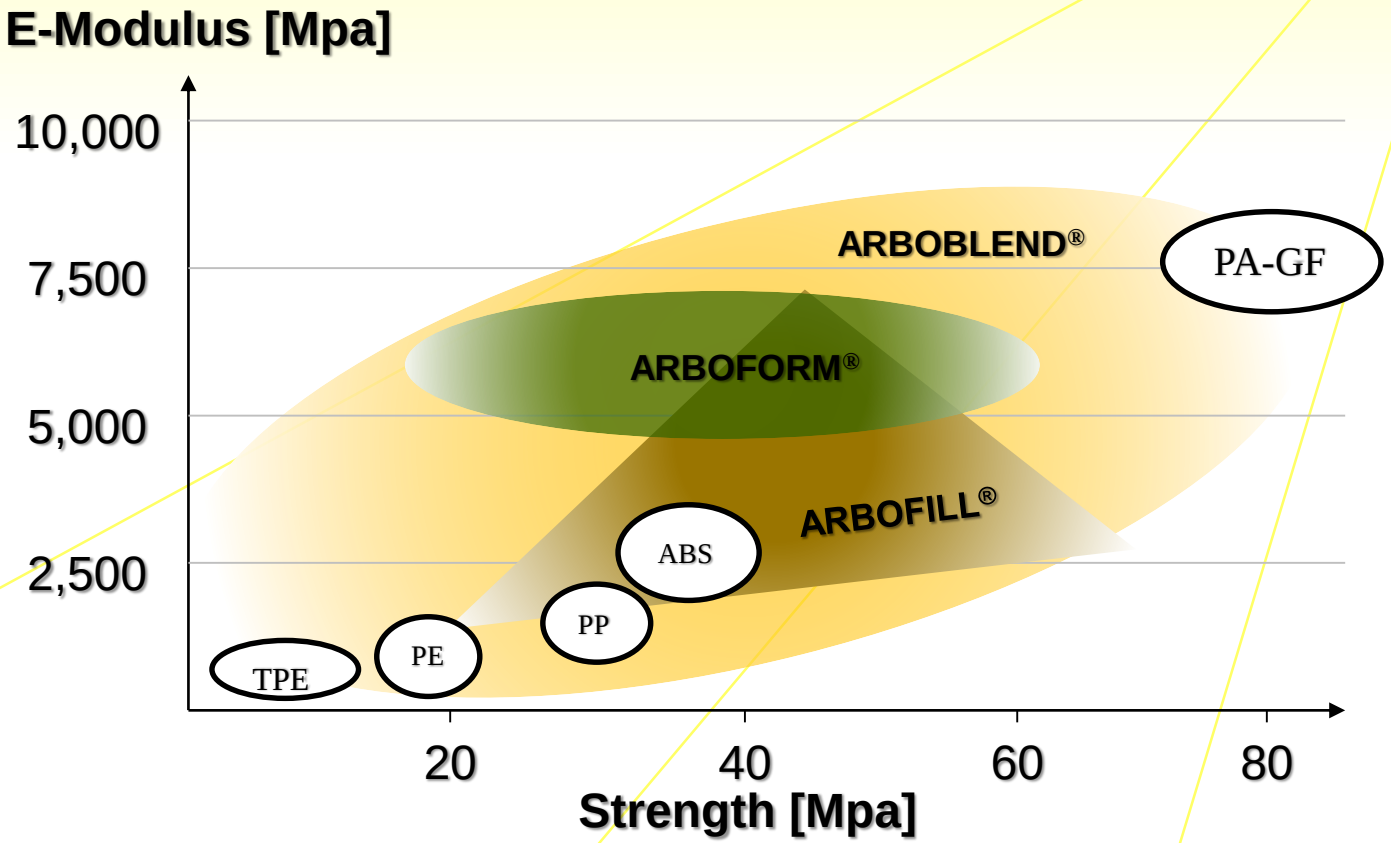
- Complete CO_2 – cycle
- Conservation of limited resources
- Alternative market for agricultural products
- Usage of natural synthesis
- New end-of-life options:
  biodegradation or energy recovery (CO_2-neutral)
- Substitution of limited crude oil resources

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

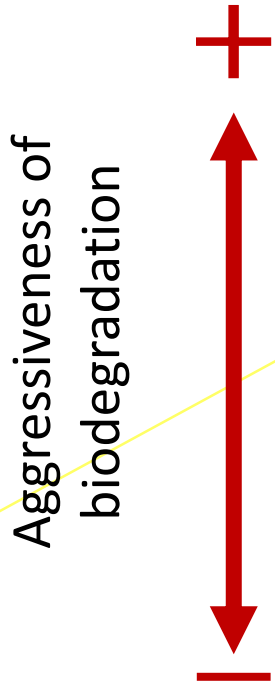

E-Modulus [Mpa]
10,000
7,500
5,000
2,500
ARBOBLEND®
PA-GF
ARBOFORM®
ARBOFILL®
ABS
PP
PE
TPE
20
40
60
80
Strength [Mpa]

Material Overview

	ARBOFORM®	ARBOBLEND®	ARBOFILL®
Types	F45, LV3, LV4, LV100	Compound families D / M / V / X *(see slide 15 for futher details)*	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, calandering, 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: A R B O F O R M ®

ARBOFORM® is based on the almost endless available but nowaday rarely used renewable ressource 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 pyrolization 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: A R B O B L E N D ®

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 biodegredable.

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 plastizied-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

Material Overview: A R B O F I L L ®

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 back-rest 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®.

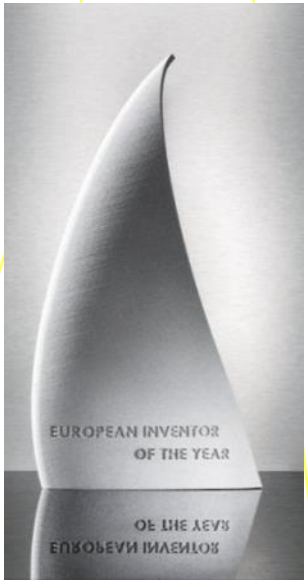
Picture: Rotho

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



15 patent families

Thank you very much für your interest!

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Additional international Distribution Partner:

ALBIS

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