Graphy

World's 1st 3D printed direct aligner

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Graphy, Inc., as a company that manufactures and supplies new materials (photopolymer resin) used in 3D printers and retains the corresponding patents both domestic and overseas, is currently supplying materials specialized for each industry around the world.

Especially in the digital dentistry market, Graphy has broaden its reputation by recognizing clinical efficacy and excellence through many consumers. Unlike the conventional indirect method, the world's first 3D printing direct aligner material (i.e. TC-85DAC) and world's best level permanent material for Crown & Bridge (i.e. TC-80DP) were independently developed and recognized for its technology.

In addition, Graphy Inc. was recognized for its technological capabilities by commercializing direct 3D printing clear aligner for the first time in the world, which everyone thought was impossible.

These new materials and the corresponding development technology, as a significant technology that is possible to forming technological value of billions US dollars, are the core of Graphy.

Graphy is planning to continue developing and introducing various professional solutions and specialized materials throughout the entire industry as well as dentistry and bio market and will present differentiated value through photopolymer resins and photo polymerization 3D printers and will be a company that can lead the Up-coming generation.

Graphy

HISTORY

2021.

06. Certificate of Promising Small and Medium Enterprise in Export
06. Certificate of Inno-Biz
01. Expanded and relocated the company building

2020.

12. Obtained medical device manufacturing authentication for Denture Base material
05. Obtained CE Class II a
04. Nominated as a company of Hi-Seoul Brand
02. Obtained medical device manufacturing authentication for the world's first Direct Printing Aligner material.
Obtained medical device manufacturing authentication for KFDA C&B Permanent material.

2019.

12. Awarded Ministry of SMEs and Startups Award, awarded accolade from the National IT Industry Promotion Agency
Obtained ISO-13485 authentication
11. Obtained GMP
Participated in FORMNEXT
Affiliated with several Global companies
05. Succeeded in A series funding
02. Awarded Ministry of Food and Drug Safety Award
01. Promoted investment from JW Holdings

2018.

09. Awarded grand prize for Challenge K-startup innovation establishment league
06. Succeed in developing transparent orthodontic appliance and new material
04.「Excellent Firm Authentication」 for technology business capability and technology competitiveness, Concluded global 3D printer company supply agreement
01. Registered digital cast patent

2017.

11. Completed factory registration
09. Authenticated as venture company
09. Established annex research institute
01. Established Graphy Co., Ltd.

DENTAL

The Dental Industry is changing rapidly from the analogue method to the digital than any other industries. With the start of the transition to the 4th industrial revolution, 3D printers were first introduced for practical use and various attempts are also being made most actively.

However, despite numerous attempts to utilize 3D printing in the field of dentistry so far, there have been many clinical limitations due to lack of equipment quality and material properties.

Graphy overcame these limitations and developed and manufactured photopolymer resins for dental use, thereby acquiring acknowledgment from numerous consumers for its technology. Graphy developed and are selling nontoxic, hypo-allergenic and biocompatibility materials with excellent material properties such as high-strength, high-temperature resistance, high precision, and are holding photopolymer resins for dental use such as world's first 3D printing clear aligner, flexible dentures, as well as permanent prosthetics, denture base, dental model and implant surgical guide resins.

Graphy materials are praised by the leading companies in the world, while reducing and simplifying the manufacturing processes using the materials developed by supplementing the problems such as long preparation processes, complex manufacturing processes, and inconvenient post-processes in manufacturing various prostheses. Graphy continues research and develop various materials and will lead innovation of the dental 3D printing market.

Direct Aligner (TC-85DAC)

The world's first 3D Printing Direct Aligner material(i.e. TC-85DAC) introduced by Graphy is an innovative material that breaks the stereotype of clear aligner so far and moves Digital Dentistry forward.

It is a material that can be optimized customizing for each patient and each step through various thicknesses printouts from the minimum size of 0.3mm according to the treatment plan and maximize the advantage of 3D printing.

The shape memory function allows patient to feel flexible and comfortable fit when wearing the aligner and the movement of the teeth can be effectively controlled after wearing.

Dental model printing is not necessary compared to the manufacturing method of the conventional clear aligner and since handwork such as thermoforming, cutting and finishing are not required, there is almost no manufacturing error occurred during the manufacturing process and manufacturing time and cost can be reduced.

Properties	Unit	TC-85DAC	Remark
Color	-	Clear	
Density	g/cm³ @ 25 ℃	1.065 ± 0.02	
Viscosity	cps @ 25 ℃	750 ± 100	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	
Shore Hardness (D)	-	≥ 80	
Flexural Strength	Mpa	≥ 70	ISO 20795-2
Flexural Modulus	Mpa	≥ 1600	ISO 20795-2

Advantages of 3D Design

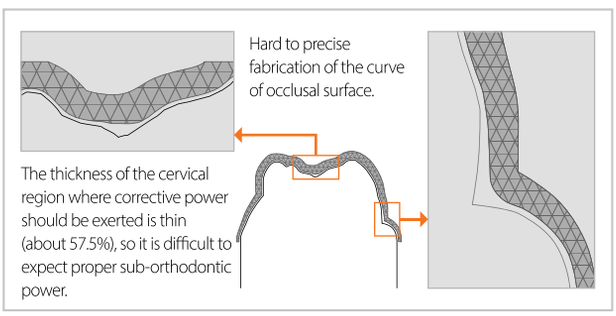
Possible to printout in the form designed by 3D Software as desired by the operator

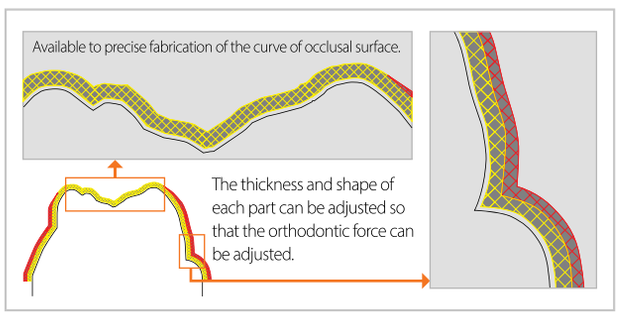
- The world first clear aligner material that can be printed with 3D printer. Direct Aligner has no shape limitation for fabrication with optimized 3D design.
- Available to adjust and design the form and the thickness of each tooth in order to make the optimal orthodontic force by designated orthodontics' plan.
- On the other hand, the current method making clear aligner such as vacuum forming has no way to adjust the form and thickness of each tooth.
- Graphy's direct 3d printed clear aligner can overcome the limitation of existing clear aligner by designing combined and optimized form and thickness for making ideal and effective tooth movement and rotation.
- Compared to the thermoforming clear aligner which is difficult to contact with detailed and complex surface, Direct aligner is expected the better treatment effect due to the perfect contact surface between teeth and aligner which is 3D Printed and Designed from 3D Scan data.

Possible to produce with minimal Block Out using 3D Software

- In case of the current method, due to the deformation and inconvenience during inserting and removing, blocking out of the cervical and interproximal space is necessary by fabricated dental model.
- Direct Aligner needs only limited blocking out onto only the excess under cut of the interproximal space using 3d software.
- The difference of the amount of block out comes from the orthodontic force by the characteristic of aligner which holds and moves the teeth. In case of the existing method, there is a risk that the tooth axis can become tilted as the contact point with the tooth is mainly formed on the upper and middle part of the crown and the cervical part proceeded with block out is reduced.
- In case of direct aligner, the orthodontic force is exerted since the entire part of the crown, up to the cervical part, is held. So, it can minimize the side effect of tilting the tooth axis and maximize the orthodontic force.

Orthodontic Force Adjustable



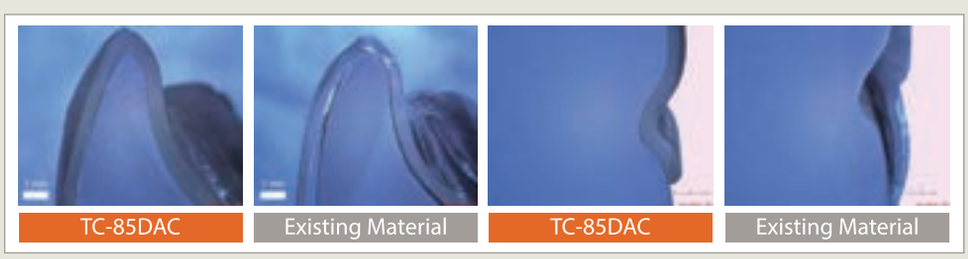


Clinical Efficacy Verified from Thesis

Even after wearing 1 week, No mechanical property changed from 3D Printed Direct Aligner by TC-85DAC.

(Citation: European Journal of Orthodontics, 2021,1-5 / doi:10.1093/ejo/cjab022 / University of Zurich/Dr.Nearchos Panayi)

Incomparable Difference



TC-85DAC	Existing Material
Uniformed thickness as designed as 0.5mm. It can always achieve the full connection where the under cut part of cervical by Shape Memory Function.	Ununiformed and stretched aligner since the thermal forming method. Gap where the under cut part due to block out.

Shape Memory

Minimize inconvenience of wearing and removing through shape memory function

The softening action of direct aligner in warm water makes patient's inconvenience of wearing and removing even the minimized block out makes the patients uncomfortable.

Enhancement of orthodontic force through shape memory function

Minimized block out of direct aligner can prove the maximum orthodontic force using shape memory function.

The recovering of orthodontic force through shape memory function

In case of Direct Aligner, when you feel its orthodontics force and elasticity decreasing, simply deep in the warm water and then recovered its the orthodontic force of the original form.

Heat disinfection is available

In case of thermoforming materials, it is completely deformed in hot water.
However, in case of Direct Aligner, even if it is contaminated by a long time usage and FOB(foreign object debris), through Heat disinfection under 100℃, it can recover a clean state and also its original shape and mechanical property.

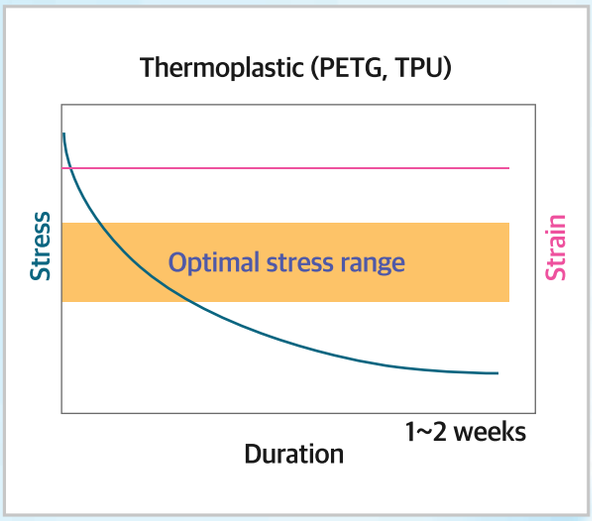
Convenience of Storage

Since shape memory function and simple heat disinfection are available, the extra exclusive case for containing is not necessary.
You are able to directly insert it in your mouth after disinfection in warm water and using shape memory function instead of storing it in a exclusive case after removed the aligner (e.g. Eating).

Perfect Transparency

Graphy always aim at making 100% transparency material.
You may not realize that wearing 3D Printed Direct Aligner or not because of the 100% transparency.
Direct Aligner are strong from discoloring and easily recovering its transparency by simply brushing it with toothpaste while existing materials are weak for discoloring and never make its color recovered.

Aligner-Stress Pelaxation



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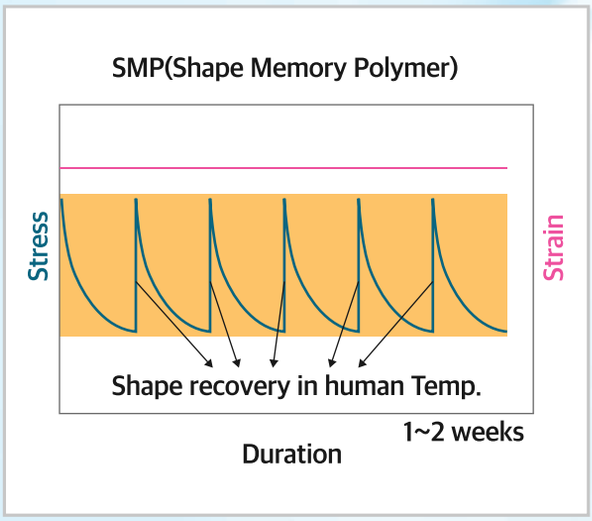
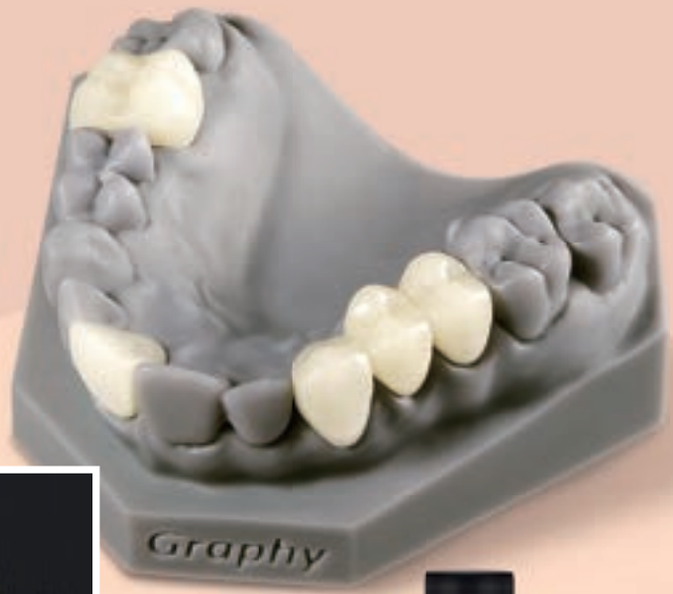
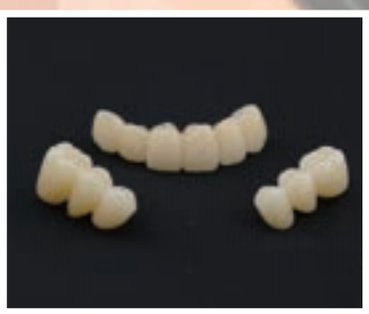


Permanent C&B (TC-80DP)





Tera Harz C&B(i.e. TC-80DP) is a permanent C&B resin with the world's highest flexural strength(ISO-10477). TC-80DP has obtained KFDA Class II, CE Class II-a medical device certification in recognition of it's stability and physical properties.

TC-80DP is a world-class 3D printing material that can be used not only temporarily but also permanently for all treatments from Single Crown to Full Mouth Bridge.

Also, TC-80DP has been proven to be usable in Inlay, Onlay and veneer through numerous clinical tests.

Properties	Unit	TC-80DP	Remark
Color	-	A1, A2 ,A3	
Density	g/cm^3 @ 25 ℃	1.075 ± 0.02	
Viscosity	cps @ 25 ℃	2500 ± 500	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	
Shore Hardness (D)	-	≥ 90	
Bi-axial Flexural Strength	Mpa	≥ 350	ISO 6872
Flexural Strength	Mpa	≥ 160	ISO 10477
Flexural Modulus	Mpa	≥ 3200	ISO 10477

Surgical Guide (SG-100)

Tera Harz SG(i.e. SG-100) perfectly implement the designed shape, enabling accurate drilling at the angle and depth intended by the operator.

Implant Surgical Guide produced by SG-100 is characterized by accurate and firm guide hole even without the use of metal sleeve.

Since HDT(Heat Distortion Temperature) is over 130℃, sterilization through autoclave is possible. Adjust the transparency of Surgical Guide is also possible through the post-processing method.

Properties	Unit	SG-100	Remark
Color	-	Clear	
Density	g/cm^3 @ 25 ℃	1.120 ± 0.02	
Viscosity	cps @ 25 ℃	700 ± 100	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	
Shore Hardness (D)	-	≥ 90	
Flexural Strength	Mpa	≥ 120	ASTM D790
Flexural Modulus	Mpa	≥ 3000	ASTM D790
Tensile Strength	Mpa	≥ 75	ASTM D638
Tensile Modulus	Mpa	≥ 2500	ASTM D638
Elongation	%	≤ 10	ASTM D638
Impact strength	J/m^2	≥ 2500	ASTM D256 (Notched)

Denture Base (THD)

Tera Harz Denture Base(i.e. THD) resin has high patient satisfaction due to it's excellent color. And it can be used for a long time without change in strength due to low moisture absorption.

If it is used with Denture Teeth produced by TC-80DP(Graphy Permanent C&B resin), you can secure world-class strength, stability, and aesthetics.

Properties	Unit	THD	Remark
Color	-	Pink, Light Pink, Coral Pink, Clear	
Density	g/cm^3 @ 25 ℃	1.056 ± 0.02	
Viscosity	cps @ 25 ℃	1200 ± 300	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	
Shore Hardness (D)	-	≥ 90	
Flexural Strength		≥ 130	ISO 20795-1
Flexural Modulus		≥ 3000	ISO 20795-1

Flexible Denture (TFDH)

Tera Harz Flexible Denture(i.e TFDH) is a resin for producing Flexible Partial Denture Base. without change in strength due to low moisture absorption.

If it is used with Denture Teeth produced by TC-80DP(Graphy Permanent C&B resin), you can secure world-class strength, stability, and aesthetics.

Properties	Unit	TFDH	Remark
Color	-	Pink, Light Pink, Dark Pink, Black Pink, Clear, White	
Density	g/cm^3 @ 25 ℃	1.025 ± 0.02	
Viscosity	cps @ 25 ℃	650 ± 100	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	
Shore Hardness (D)	-	≥ 90	
Flexural Strength	Mpa	≥ 95	ISO 20795-1
Flexural Modulus	Mpa	≥ 2500	ISO 20795-1

Model
(S-100M)

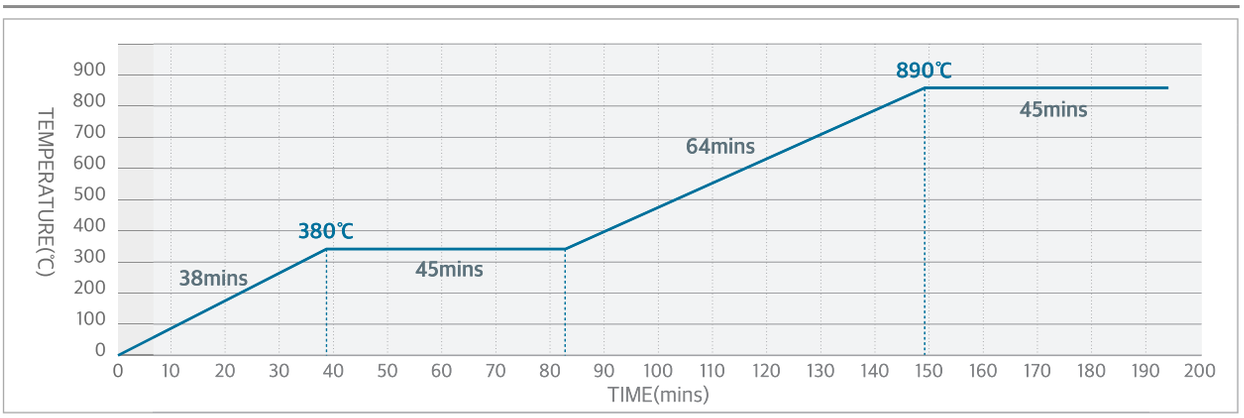
Among 3D printing materials, the most common and used for a long time in the digital dentistry market are dental model material. Graphy Dental Model(i.e. S-100M) enables precise and easy reproduction of oral data acquired through the Intra Oral Scanner. It reduces the time and cost of producing dental model and helps to accurately reproduce the oral environment.

Properties	Unit	S-100M	Remark
Color	-	Gray·Beige	
Density	g/cm^3 @ 25 ℃	1.120 ± 0.02	
Viscosity	cps @ 25 ℃	600 ± 100	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	
Shore Hardness (D)	-	≥ 90	
Flexural Strength	Mpa	≥ 120	ASTM D790
Flexural Modulus	Mpa	≥ 3000	ASTM D790
Tensile Strength	Mpa	≥ 75	ASTM D638
Tensile Modulus	Mpa	≥ 2500	ASTM D638
Elongation	%	≤ 10	ASTM D638
Impact strength	J/m^2	≥ 2100	ASTM D256 (Notched)

Castable (SC-130)

Metal prostheses have the longest history in the dental field. In the past, Wax Up which is complex process was absolutely necessary to manufacture these prostheses. However, as 3D Printing was introduced into the digital dentistry market, it became possible to design a casting by 3D modeling and to manufacture a precise casting more easily and quickly by 3D Printer.

Properties	Unit	SC-130	Remark
Color	-	Green	
Density	g/cm^3 @ 25 ℃	1.110 ± 0.02	
Viscosity	cps @ 25 ℃	200 ± 30	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	



TE-Series

Demand regarding flexible and elastic materials has been increasingly in the field of dentistry such as mouth guard night guide.

Most of the products using existing materials such as silicone are ready-made products, and in the case of personalized products required by dentists, it takes a long time to manufacture and often requires a lot of cost.

This material can be made with 3D printer, reducing production time and cost compared to conventional materials.

Properties	Unit	TE-Series	Remark
Color	-	Clear	
Density	g/cm^3 @ 25 ℃	1.065 ± 0.02	
Viscosity	cps @ 25 ℃	1000 ± 200	BrookField
Solid content	% @ 80 ℃ x 1h	≥ 98	
Shore Hardness (A)	-	≥ 65	
Tensile Strength	Mpa	≥ 10	ASTM D638
Elongation	%	≤ 110	ASTM D638

Gingiva Mask (TE-600R)

Tera Harz Gingiva Mask is gingiva-like material with flexible and soft texture. It is ideal for combination with implant models. Tera Harz Gingiva Mask resin has excellent elasticity and tear-resistance and reproduces the feeling of an actual gums. Due to the its high accuracy, dental technician can print gingiva mask easier, which perfectly fit the dental models, and with its smooth surface finish can have the optimum results in the aesthetic aspect.

Properties	Unit	TE-600R	Remark
Color	-	Red	
Viscosity	cps @ 25℃	2300 ± 100	Brookfield
Solid content	% @ 80 ℃ * 1h	≥ 98	
Shore Hardness (A)	-	≥ 33	
Tensile Strength	Mpa	≥ 0.5	ASTMD638
Tear Stength	%	≥ 190	ASTMD638
Elongation	kN/m%	≥ 4	ASTMD624

THC2

Tera Harz Cure

Tera Harz Cure is made by high UV Energy and Irradiance in order to reach the rapid curing time,
Maximized mechanical property such as both flexural and tensile strength, and natural teeth shade.
For the perfect photopolymerization with the ideal chemical reaction, it can adjust the UV Power (Lv.1 to Lv.5) and curing time. High Power UV LEDs are located with optimized arrangment both top and side.

- **Memory Function (Up to 4 Mode)**
- **Safety System (Auto Power-off)**
- **7.9” Touch Screen**
- **Diagnostic Function**
- **Light Uniformity**

THC2

Tera Harz Cure

Background

To realize the features that the photopolymerization materials have 100% post-processing is significantly important. In particular, in case of biocompatible material used in the dentistry, if complete curing and cleaning are not performed properly, extract (toxic substance) may remain, which can be a problem for both the surgical operator and the patient.

※ Nitrogen Curing (Optional)

With Nitrogen generator, Graphy Materials can reach the maximum mechanical property, color, prevention of water absorption, and Etc.

Tera Harz Cure Specification

Light Source	UV LED
UV Wavelength	405nm
Input Voltage	100-240VAC / 50~60Hz
LED Power Output	200W
UV Energy Density	280,000 mJ/cm^2 (5 Min)
Irradiance of UV	1,000 mW/cm^2
Curing Chamber	Ø180 x 65 mm
Outer Dimension	275 x 310 x 310 mm
Net Weight	9 kg

Graphy

3D Print the World with Graphy's Solutions

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