

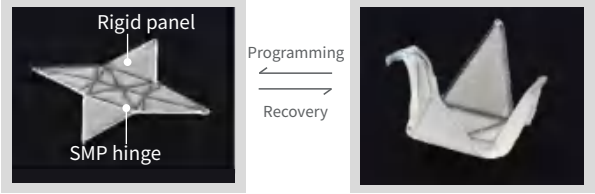
APPLICATION CASE

01

Multimaterial Origami

Dimensions: 25×25×0.6 mm³
Characteristics: Shape reconfiguration of hard panel /SMP hinges through thermomechanical programming
Applications: 4D printing, foldable structures

RIGID POLYMER + SHAPE MEMORY POLYMER

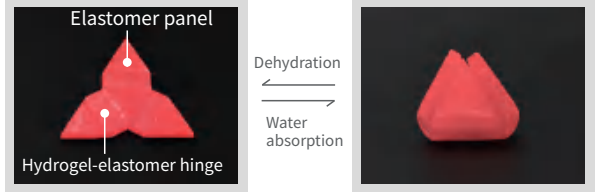


02

Multimaterial Origami

Dimensions: 27×24×1.6 mm³
Characteristics: Elastomer-hydrogel laminate evolves into 3D structure driven by hydrogel dehydration
Applications: 4D printing

ELASTOMER + HYDROGEL

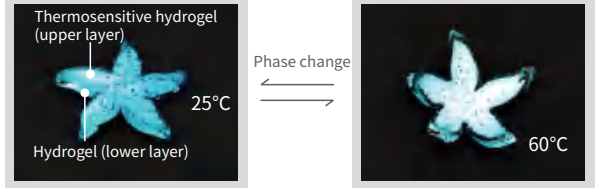


03

Multimaterial Laminate

Dimensions: 25×25×2 mm³
Characteristics: Phase change of thermo sensitive hydrogel drives the laminate to deform
Applications: 4D printing, sensors

HYDROGEL + THERMOSENSITIVE HYDROGEL

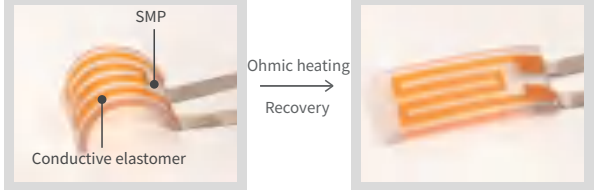


04

Joule Heating Circuit

Dimensions: 30×12×1.5 mm³
Characteristics: Ohmic heating drives SMP/conductive elastomer structure to restore its initial shape
Applications: Intelligent unfolding structures

SHAPE MEMORY POLYMER + CONDUCTIVE ELASTOMER

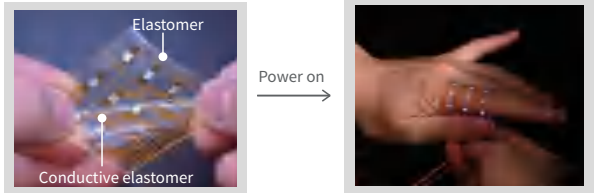


05

Flexible Circuit

Dimensions: 30×30×0.5 mm³
Characteristics: Combining elastic substrate with conductive elastic circuit enables the realization of wearable electronics.
Applications: Flexible electronics, sensors

ELASTOMER + CONDUCTIVE ELASTOMER



Related Papers

1. Rong Wang, Chao Yuan, Jianxiang Cheng. et al., Direct 4D printing of ceramics driven by hydrogel dehydration. Nature Communications, 15, 758 (2024)
2. Honggeng Li, Biao Zhang, Haitao Ye, et al., Reconfigurable 4D printing via mechanically robust covalent adaptable network shape memory polymer. Science Advances, 10, eadl4387(2024)
3. Xiangnan He, Biao Zhang, Qingjiang Liu, et al., Highly conductive and stretchable nanostructured ionogels for 3D printing capacitive sensors with superior performance. Nature Communications, 15, 6431 (2024)
4. Caicong Li, Jianxiang Cheng, Yunfeng He, et al., Polyelectrolyte elastomer-based ionotronic sensors with multi-mode sensing capabilities via multi-material 3D printing. Nature Communications, 14, 4853 (2023)
5. Qi Ge, Zhe Chen, Jianxiang Cheng. et al., 3D printing of highly stretchable hydrogel with diverse UV curable polymers.Science Advances, 7,eaba4261(2021)
6. Jianxiang Cheng, Rong Wang, Zechu Sun, et al.,Centrifugal multimaterial 3D printing of multifunctional heterogeneous objects. Nature Communications, 13, 7931 (2022)
7. Biao Zhang, Honggeng Li, Jianxiang Cheng, et al., Mechanically Robust and UV-Curable Shape-Memory Polymers for Digital Light Processing Based 4D Printing. Adv. Mater. , 33, 27, 2101298 (2021)
8. Xiangnan HeJianxiang ChengZhenqing Li, et al., Multimaterial Three-Dimensional Printing of Ultraviolet-Curable Ionic Conductive Elastomers with Diverse Polymers for Multifunctional Flexible Electronics. ACS Appl. Mater. Interfaces, 15, 2, 3455–3466(2023)

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Multimaterial 4D Printing

microArch® M150

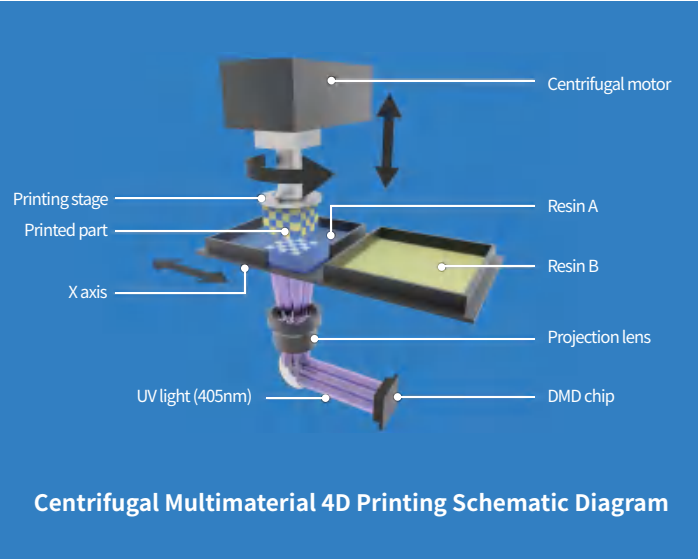


INTRODUCTION

A vat photopolymerization multimaterial 4D printer for manufacturing parts of various materials, including shape-memory polymers, conductive elastomers, elastomers, hydrogels, and rigid resins.

Product Specifications

Product Model	M150/M150Pro
Light source	UV LED (405 nm)
Optical resolution	25 μm
Z-axis resolution	±2 μm
Number of resin vat	3
Printing mode	Intra-layer / Inter-layer multimaterial
Centrifuge speed	10000 rpm
Printing platform diameter	Φ42 mm / Φ56 mm
Build size - height	30 mm
External dimension	950mm(L)×650mm(W)×700mm(H)
Product weight	100KG



FOUR MAJOR FUNCTIONAL FEATURES

1 >>>> Centrifugal multimaterial switching technology

The exclusively developed centrifugal multimaterial switching technology enables efficient material switching and residue removal. The centrifugal speed is adjustable, reaching up to 10,000 RPM, allowing for rapid switching in 60s. The maximum number of switching times in a single printing can reach up to 2,500, which is at the leading level in the industry.

3 >>>> Extensive materials for 4D printing

The system supports multimaterial 4D printing of rigid resins, elastomers, hydrogels, shape memory polymers, conductive elastomers, and arbitrary combinations of these materials, with viscosities ranging from 5 to 5000 cps. This provides flexibility in material selection for applications in various fields.

Technical Principles

405nm UV light is projected upward from below onto the liquid surface of functional materials to induce curing. Residual liquid is rapidly removed via high-speed centrifugal force from the printing platform, enabling faster switching between multifunctional materials. This process continues until an integrated, high-complexity, high-precision, multifunctional, multimaterial coupled structure part is achieved.



Centrifugal Multimaterial 4D Printing Flowchart

2 >>>> Efficient multi-material slicing software

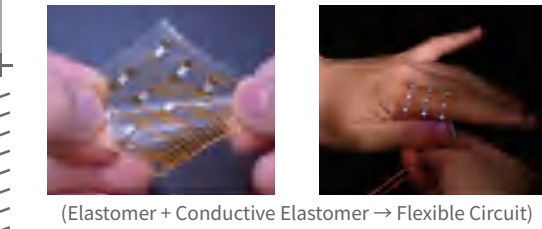
Independently developed multimaterial model slicing software that generates file formats for automatic multimaterial printing. It supports slicing of multimaterial models with arbitrary spatial distribution of materials. The slicing speed can reach up to 500 layers per minute, meeting the rapid slicing requirements for multimaterial models.

4 >>>> Easy fabrication of monolithic multimaterial coupled structure

The system can print high-complexity, high-precision, multifunctional, and multimaterial coupled structures. It supports simultaneous printing of 3 materials, enabling the efficient multimaterial switching between intra-layer and inter-layer. The transition zone between different materials is less than 100µm.

TYPICAL APPLICATION

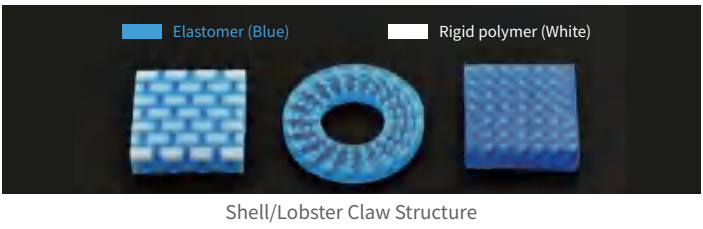
Flexible Electronics/Sensor



Metamaterial Robotics



Biomimetics



Biomedicine



MATERIAL PARAMETERS

Rigid Resin

Material	Tensile Strength	Fracture Strain	Young's Modulus
RP1	40 MPa	5%	1600 MPa
RP2	25 MPa	16%	1000 MPa
RP3	32 MPa	10%	1300 MPa

Elastomer

Material	Tensile Strength	Fracture Strain	Young's Modulus
EP1	8 MPa	150%	30 MPa
EP2	8.5 MPa	700%	9.0 MPa
EP3	0.49 MPa	300%	0.38 MPa
EP4	5.0 MPa	700%	0.5 MPa

Hydrogel

Material	Water Content	Fracture Strain	Young's Modulus	LCST
HG1T	90%	—	—	40 °C
HG2	80%	800%	7 kPa	—

Shape Memory Polymer (SMP)

Material	Tensile Strength	Fracture Strain	Young's Modulus	T _g	Recovery Ratio
SP1 (25 °C)	16 MPa	250%	300 MPa	62 °C	99%
SP1 (87 °C)	0.3 MPa	400%	0.2 MPa		

Conductive Elastomer

Material	Tensile Strength	Fracture Strain	Young's Modulus	Conductivity
CE1	0.1 MPa	600%	300 kPa	8.0 x 10 ⁻⁴ S/m

Layer-Slicing of Multimaterial Models

Diagram illustrating the layer-slicing of multimaterial models. It shows four types of models: Inter-layer multimaterial model, Intra-layer multimaterial model, Inter/intra-layer multimaterial model, and Random distributed multimaterial model. Each model is shown with its corresponding slicing parameters and the resulting printed structure.

Multimaterial 3D Printing Capacity

Diagram illustrating the multimaterial 3D printing capacity. It shows four types of models: Single Material, Multimaterial, and two types of Multimaterial models. Each model is shown with its corresponding printing parameters and the resulting printed structure.

Multimaterial Makes New Possibilities

- Rigid polymers | Elastomers
- Rigid polymers | SMPs
- Elastomers | Hydrogels
- Hydrogels | Thermosensitive hydrogels
- SMPs | Conductive elastomers
- Elastomers | Conductive elastomers