SMART MCs

HAMA Material Characterisation

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Product Overview

HAMA (Hyaluronic Acid Methacryloyl) is a light-curable hydrogel derived from hyaluronic acid, widely used in biomedical research for its high biocompatibility, fast gelation, and tunable mechanical properties. It supports applications such as tissue engineering, 3D bioprinting, drug delivery, and wound healing, and can be combined with GelMA to better replicate in vivo tissue environments.

- Fast Gelation: Cures under visible light in under 10 seconds
- Tunable Stiffness: Adjustable viscoelasticity through concentration control
- Compressive Modulus: Ranges from ~0.5 kPa to 147 kPa depending on formulation
- Versatile Use: Ideal for 3D printing, microneedles, biosensors, and more
- Modifiable Chemistry: Reactive groups allow for easy functionalization
- Compatible with GelMA: For enhanced bio-ink performance and 3D culture

1. General Information

Model	DoF	Molecular Weight	Viscosity	Appearance	Formats Available
HAMA – 150K	30~40	100–200 kDa	Medium	White spongy	0.5g/vial (w/ LAP)
HAMA – 400K	20~30	300–400 kDa	High	White spongy	0.2g/vial (w/ LAP)

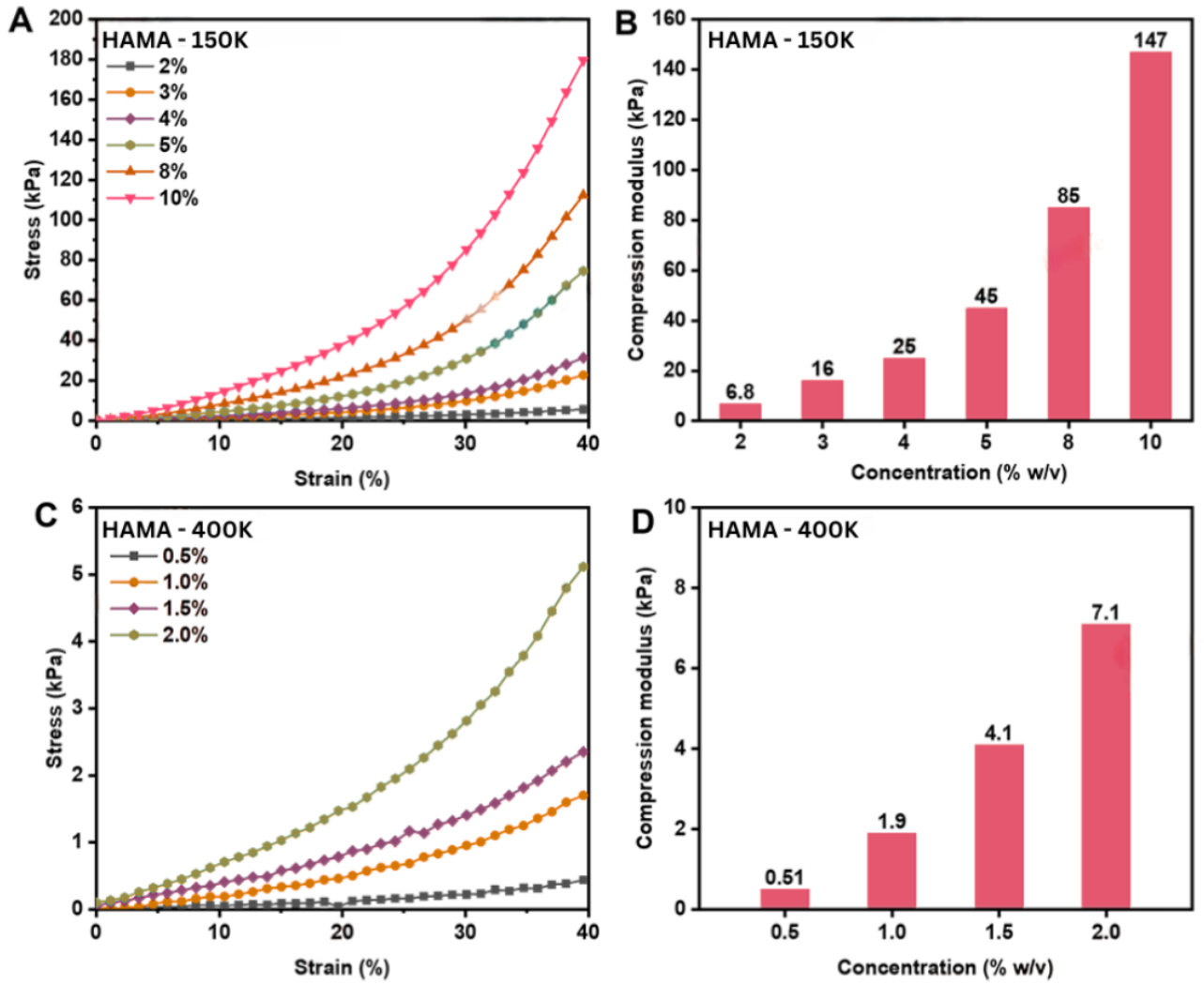
2. Compressive Modulus Comparison

Mechanical performance of HAMA-150K and HAMA-400K hydrogels varies by concentration and molecular weight. HAMA-150K offers a wide stiffness range (6.8–147 kPa) suitable for structural constructs, while HAMA-400K remains much softer (0.5–7.1 kPa), ideal for delicate or soft tissue applications.

HAMA – 150K Concentration (%)	Compressive Modulus (kPa)
2	6.8
3	16
4	25
5	45
8	85
10	147

HAMA – 400K Concentration (%)	Compressive Modulus (kPa)
0.5	0.51
1.0	1.9
1.5	4.1
2.0	7.1

Figure 1: Mechanical Properties of HAMA Hydrogels Compression and Stress-Strain Analysis of HAMA-150K and HAMA-400K.



(A, C) Stress-strain curves across varying concentrations highlight the concentration-dependent mechanical response.
(B, D) Corresponding compression modulus values demonstrate tunable stiffness ranging from 0.5 kPa to 147 kPa depending on formulation

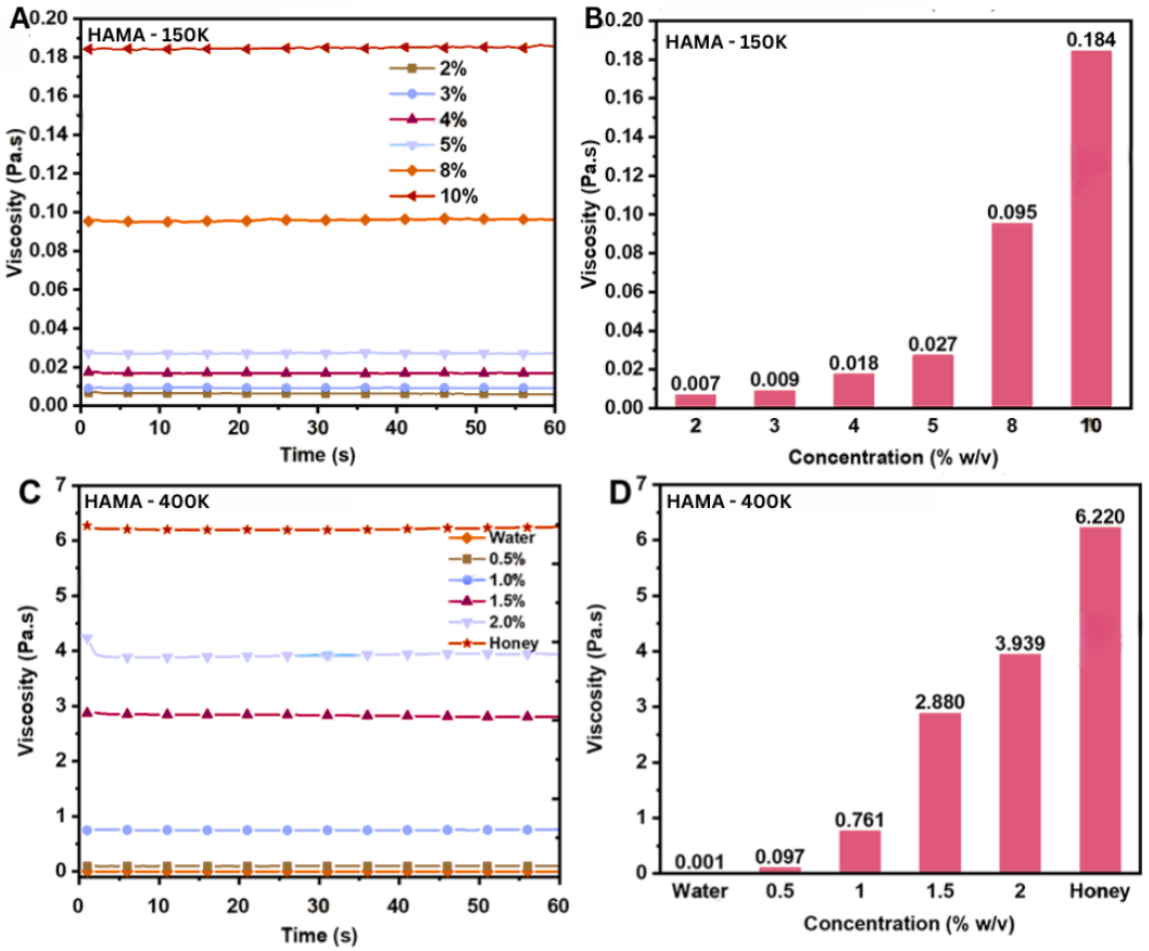
3. Viscosity Comparison

Viscosity affects mixing and printability. HAMA-150K is relatively fluid (0.007–0.184 Pa·s), while HAMA-400K becomes highly viscous even at low concentrations (up to 3.939 Pa·s at 2%), supporting superior shape retention and slower flow behaviour.

HAMA – 150K Concentration (% w/v)	Viscosity (Pa•s)
2	0.007
3	0.009
4	0.018
5	0.027
8	0.095
10	0.184

HAMA – 400K Concentration (% w/v)	Viscosity (Pa•s)
0.5	0.097
1.0	0.761
1.5	2.880
2.0	3.939
Honey (control)	6.220
Water (control)	0.001

Figure 2: Viscosity Profile of HAMA-150K and HAMA-400K.



(A, C) Time-dependent viscosity measurements demonstrate stability during measurement.
(B, D) Static viscosity values show increasing viscosity with concentration. Honey and water were included as reference materials for comparative analysis.

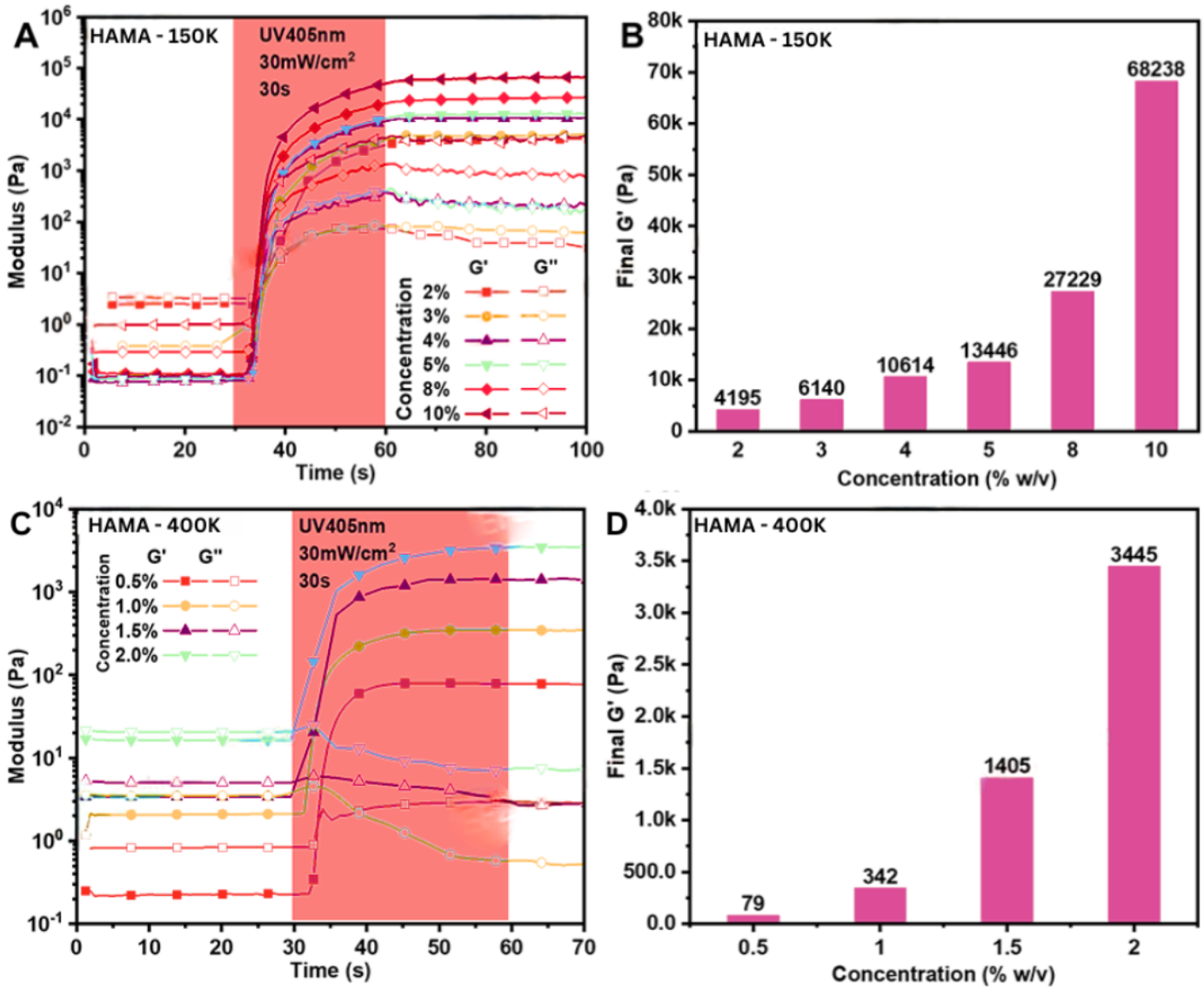
4. Storage Modulus Comparison

Storage modulus (G′) reflects elastic response post-photocuring. HAMA-150K reaches up to 68,238 Pa at 10%, confirming rapid and stiff gel formation. HAMA-400K, with G′ up to 3,445 Pa, is suitable for applications requiring softer mechanics and more flexible matrices.

HAMA – 150K Concentration (% w/v)	Storage Modulus G' (Pa)
2	4195
3	6140
4	10614
5	13446
8	27229
10	68238

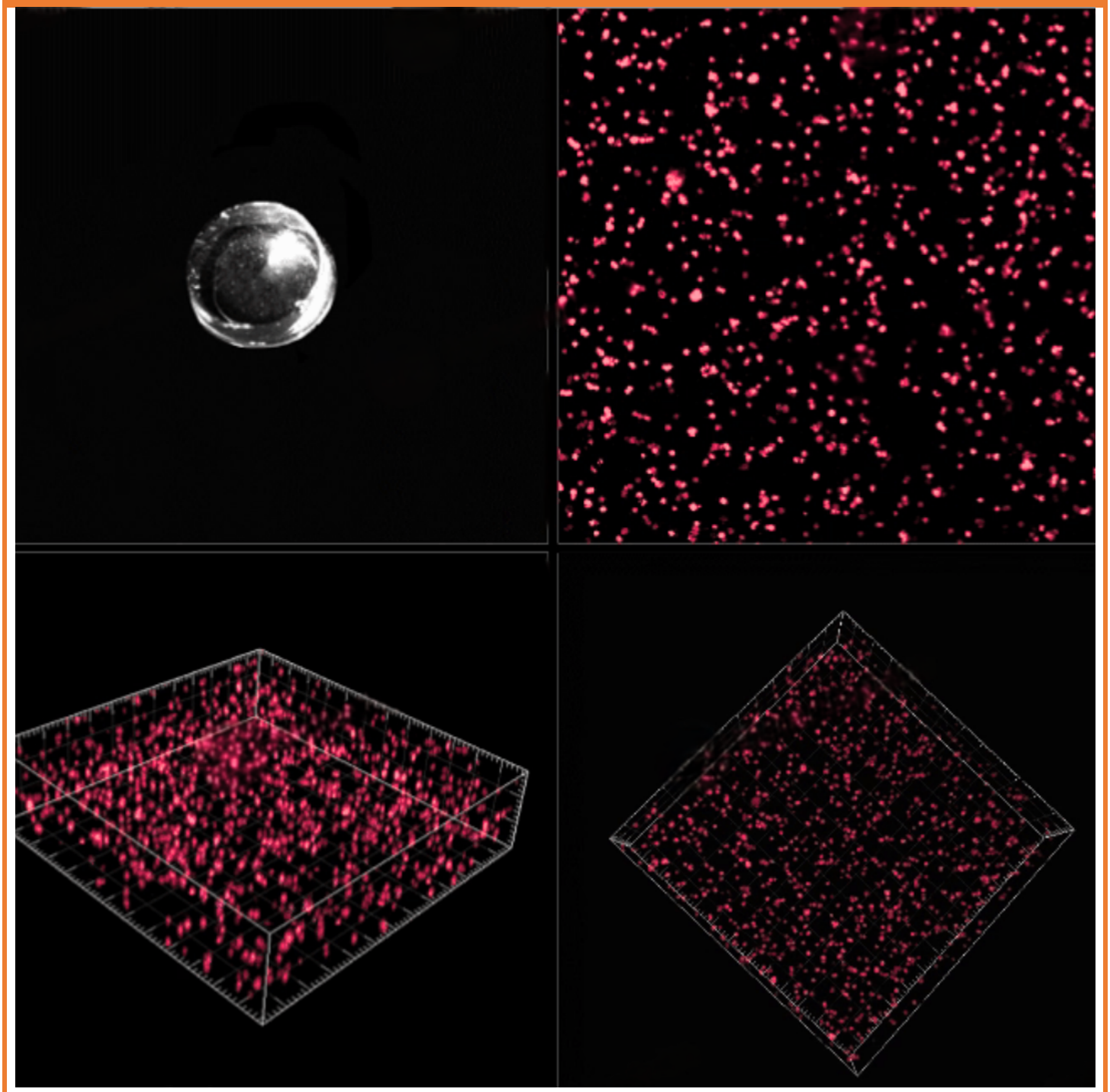
HAMA – 400K Concentration (% w/v)	Storage Modulus G' (Pa)
0.5	79
1.0	342
1.5	1405
2.0	3445

Figure 3. G' Storage Modulus Following Photocuring



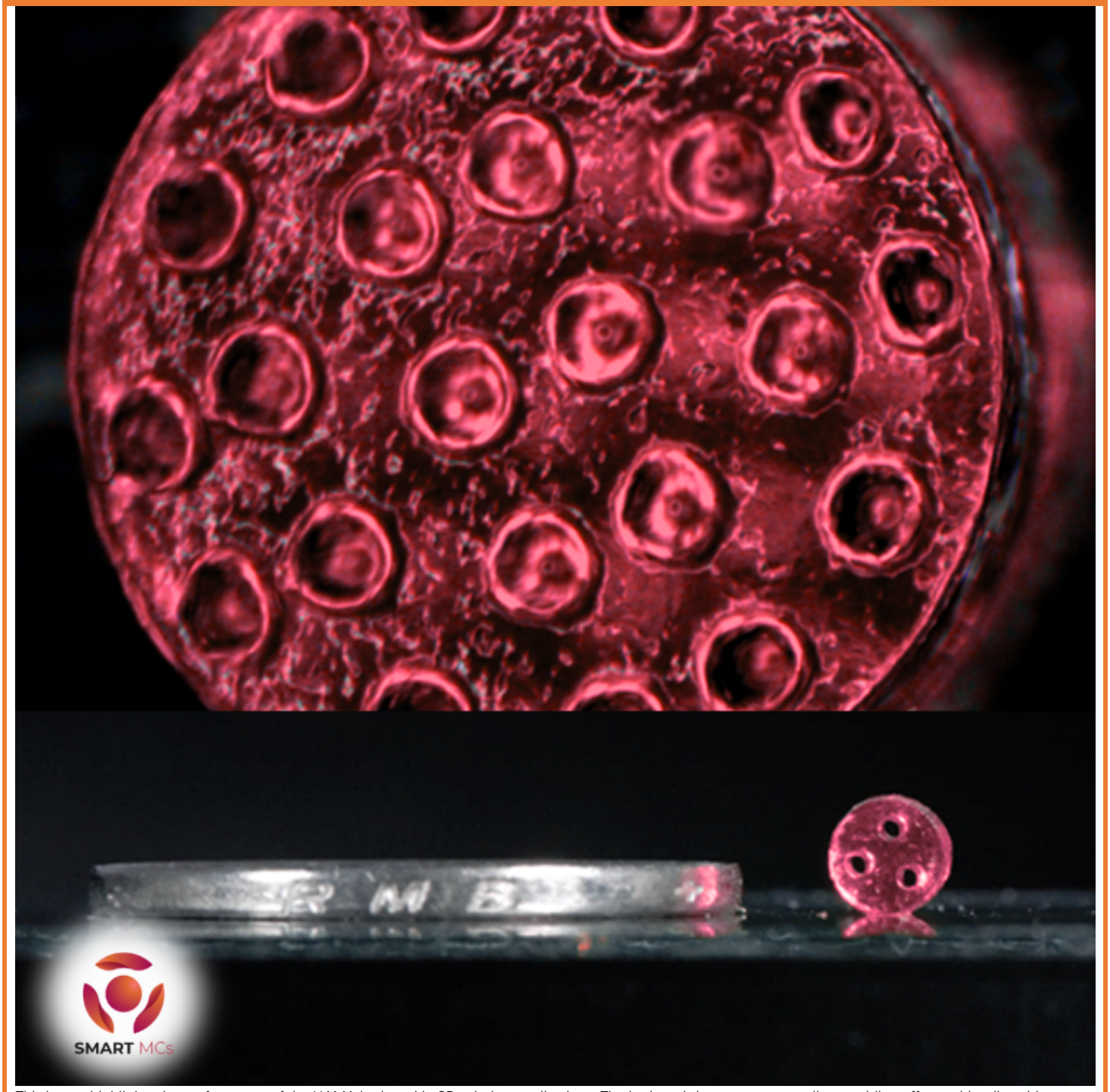
((A, C) Modulus measurements over time show rapid gelation under UV light (405 nm, 30 mW/cm² for 30s).
(B, D) Final G' values increase with concentration, demonstrating tunable stiffness across formulations.

Figure 4. HAMA Hydrogel 3D Cell Culture



This image highlights the HAMA hydrogel's performance in 3D cell culture, with red fluorescent cells visible within the matrix, demonstrating biocompatibility and cell behavior.

Figure 5. HAMA Hydrogel 3D Printing Performance



This image highlights the performance of the HAMA hydrogel in 3D printing applications. The hydrogel demonstrates excellent molding effects with adjustable mechanical properties, showcasing its suitability for projection light-curing (DLP) 3D printing in creating complex shapes.

Which HAMA Should You Use?

Select the variant that best fits your application needs:

HAMA-150K (Medium Molecular Weight)

- Moderate viscosity — printable and easy to mix for extrusion and DLP setups
- Tunable stiffness (~6.8–147 kPa) — suitable for structural constructs and engineered tissue scaffolds, particularly for soft tissue models and in vitro applications
- High storage modulus (~68,238 Pa) — ensures strong gelation and mechanical stability after curing
- Ideal for microneedles, biosensors, wound healing, and soft tissue models

HAMA-400K (High Molecular Weight)

- Higher viscosity — greater shape retention and slower flow
- Softer mechanical profile (0.5–7.1 kPa) — better suited for delicate, compliant tissue constructs
- Storage modulus up to ~3,445 Pa — supports soft gel behaviour with moderate elasticity
- Suitable for injectable systems, drug delivery, and composite use with GelMA or SilkMA

All HAMA variants cure under 405 nm light with LAP and integrate seamlessly into composite bioinks for enhanced printability and biological response.