**Supplementary Material**

**Natural Eggshell Membranes Exhibiting Programmable**

**Shape Recovery Characteristics**

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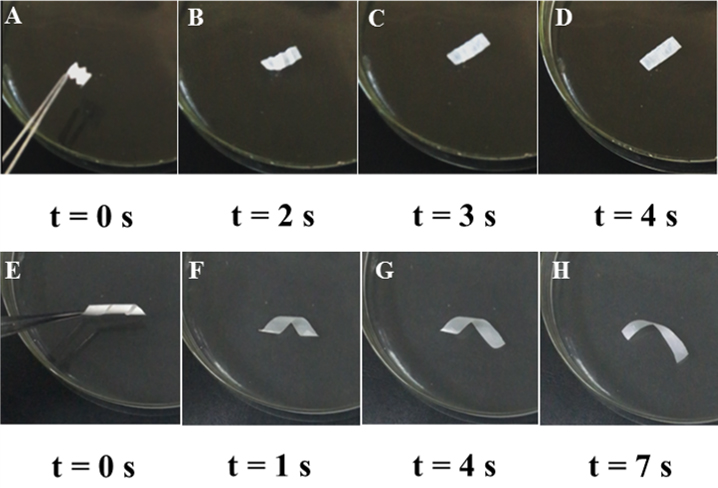
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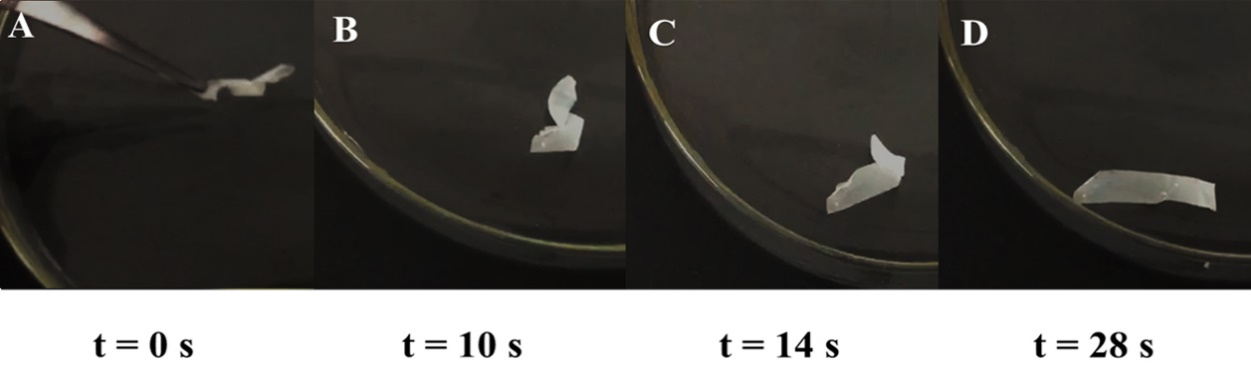
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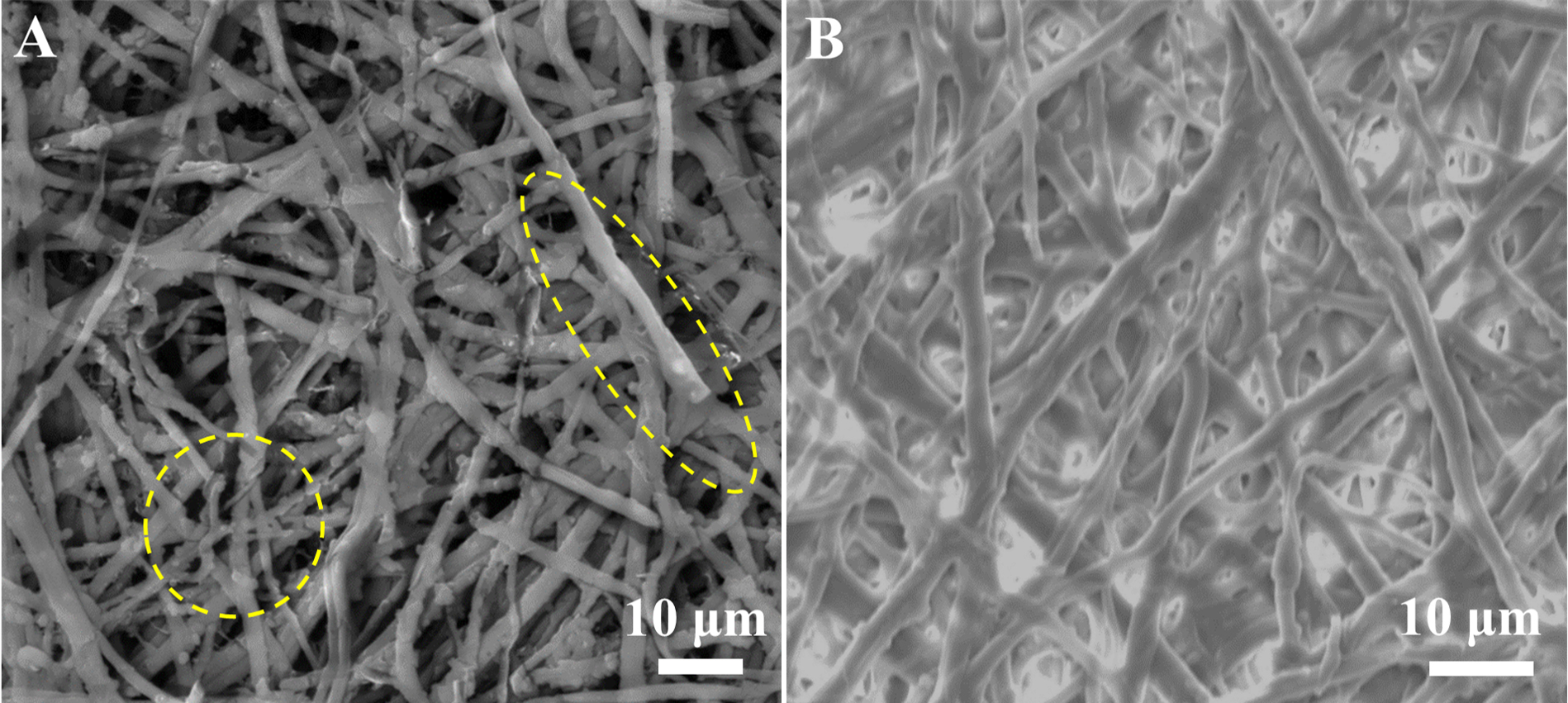
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**Figure S1.** The shape recovery process for (A-D) a goose ESM sample and (E-H) a quail ESM sample from the temporary helical shape in dry status to the original flat shape through hydration in water at room temperature.

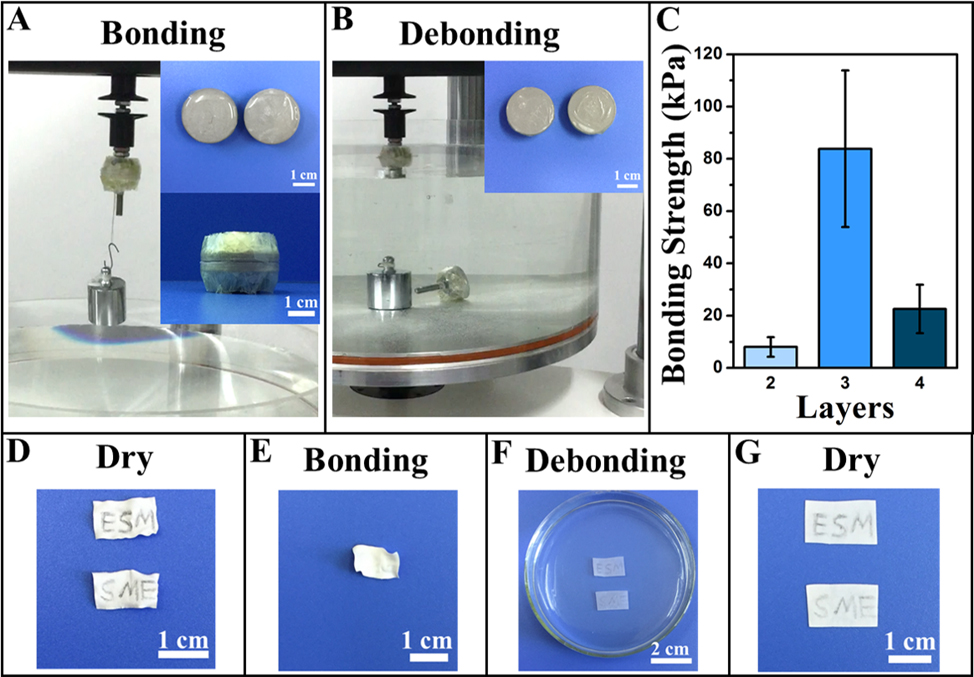
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**Figure S2.** The shape recovery process for (A-D) a dry zigzag-shape ESM sample and (E-H) a dry helical-shape ESM sample through hydration in a 70% (v/v) ethanol-water solution at room temperature.

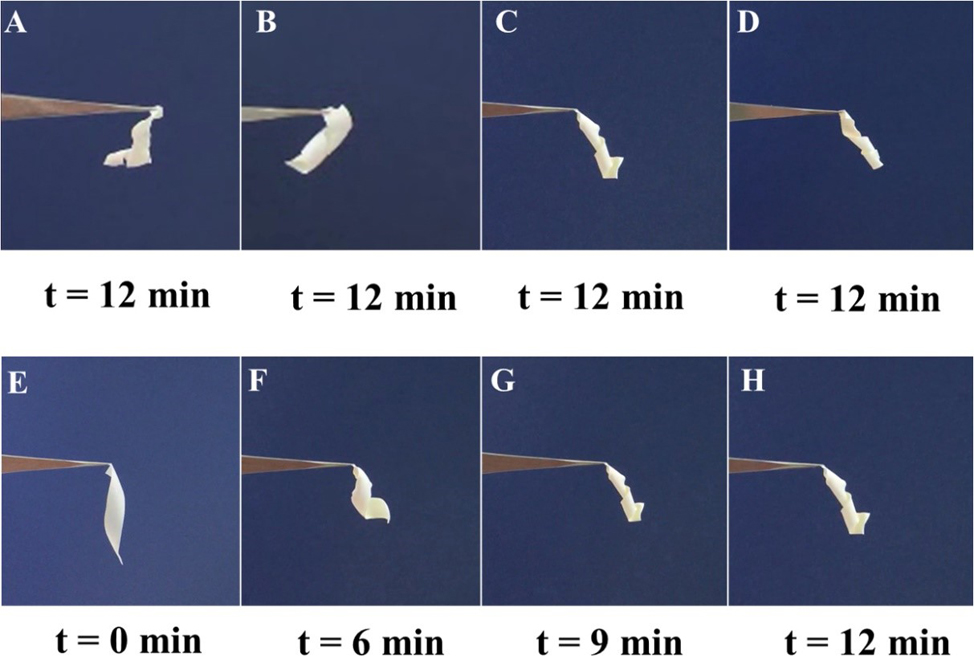
**Figure S3.** (A-D) The shape recovery process for a dry helical-shape thiolated-ESM sample through hydration in water at room temperature.



**Figure S4.** SEM morphology of fiber structures for (A) denatured-ESM samples and (B) the thiolated-ESM. Yellow dash circles in (A) indicate the disruption of fiber structures by denaturation.



**Figure S5. (**A,B) The adhesion trials between different ESM layers. (C) Bonding strength among ESM layers based on tension tests. (D-G) Illustration ofreusable adhesiveby ESM samples using their shape memory effects.



**Figure S6.** (A-D) The shape recovery of wet helical-shape GA-ESM samples with GA crosslinking for different periods: (A) 15 min, (B) 30 min, (C) 1 hour, (D) 2 hours, followed by dehydration in air for 12 min. (E-H) The shape recovery process of a wet GA-ESM sample with GA crosslinking for an hour through dehydration in air.



**Figure S7.** Schematic illustration of hierarchical structures of ESM and their roles in the shape memory effect. (A) Illustration of the double-layer membranes of an ESM sample. (B) The core-mantle structure of an ESM fiber. (C) The well-aligned collagen triple-helical molecular chains. (D) The triple-helical molecular chain and intramolecular H-bonds and disulfide bonds. (E) The thiolation reaction by S-S bond cleavage. (F) Disruption of assembled triple-helical molecular chains by denaturation.



**Figure S8.** Schematic illustration of (A) the ESM fiber network under dry status and (B) the ESM fiber network with water diffusion under wet status. (C) The intermolecular H-bonds among ESM proteins under dry status. (D) The H-bonds between ESM proteins and bound water under wet status.