

Supplementary Movie 1: Formation process of fishbone-like branching microscale structures emerging from the bottom of bubbles ($d = 19.7$ mm and 22.5 mm) in the 1.3 wt% HASE solution. The video demonstrates the simultaneous growth of structures from both the left and right sides.

Supplementary Movie 2: Formation process of fishbone-like branching microscale structures emerging from the bottom of bubbles ($d = 19.7$ mm and 22.5 mm) in the 1.3 wt% HASE solution. This video highlights the formation of structures originating from a single side.

Supplementary Movie 3: Formation of thin filamentary structures emerging from the edge of the elongated trailing tail of a bubble ($d = 11.5$) rising in the 2.1 wt% HASE solution.

Supplementary Movie 4: Formation process of complex, jagged branching microscale structures emerging from the bottom of a bubble ($d = 12.4$ mm) in the 2.1 wt% HASE solution.

Supplementary Movie 5: Formation process of extremely elongated trailing tails featuring jagged microscale structures, emerging from the bottom of a bubble ($d = 14.5$ mm) in the 2.1 wt% HASE solution.

Supplementary Movie 6: Magnified view of the formation process of extremely elongated trailing tails featuring jagged microscale structures, originating from the bottom of a bubble ($d = 14.5$ mm) in the 2.1 wt% HASE solution.