SUPPORTING INFORMATION

Nonspherical Double-Emulsions with Multiple Distinct Cores Enveloped by Ultra-Thin Shells

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S1. Supplementary Figures

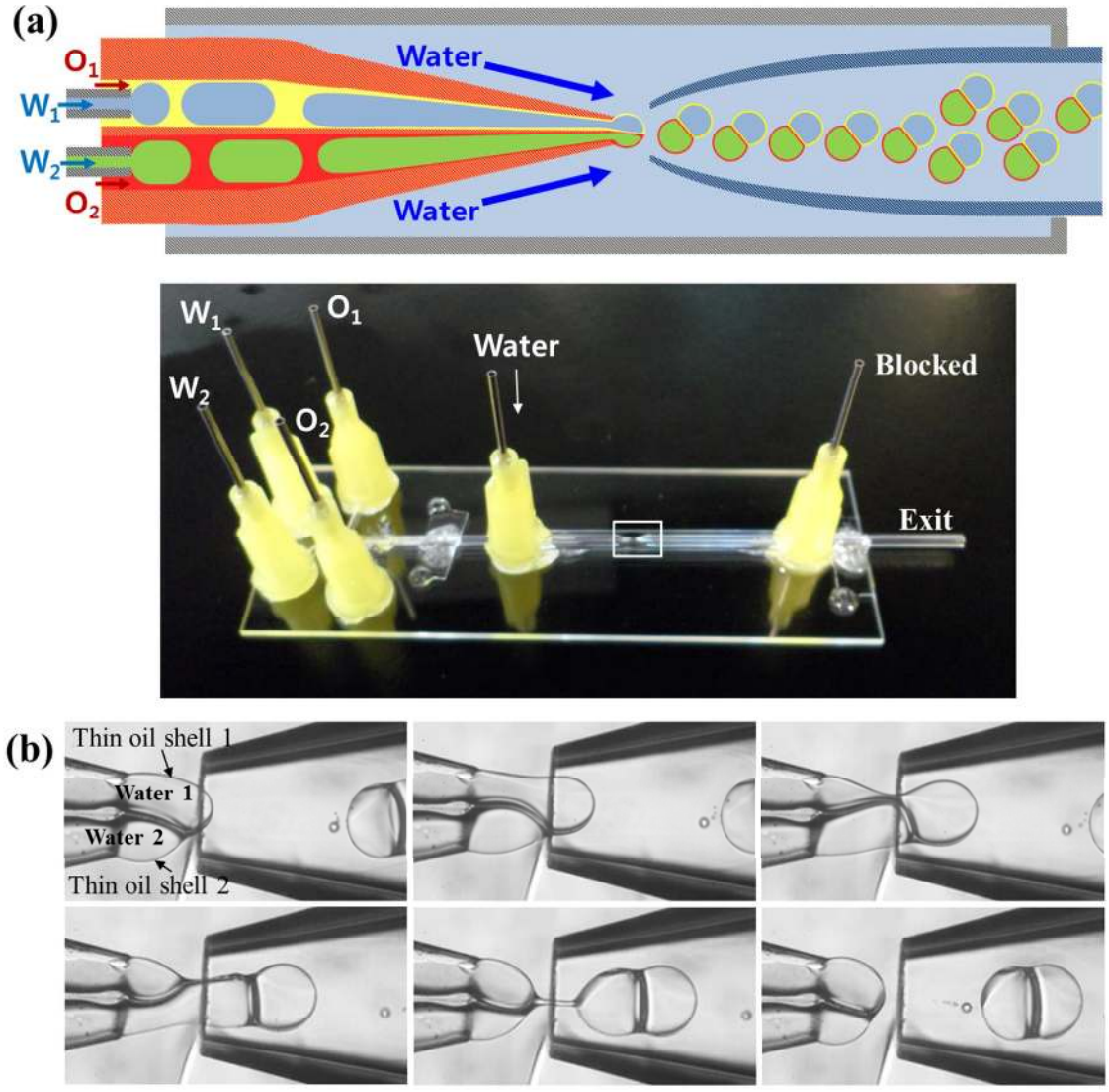

Figure S1. (a) Schematic illustration and image of the microfluidic device for preparation of double-emulsion drops with two distinct cores covered by two different ultra-thin shells. (b) A series of still shot images showing formation of dumbbell-shaped double-emulsion drops, where images are taken with interval of 5 ms.

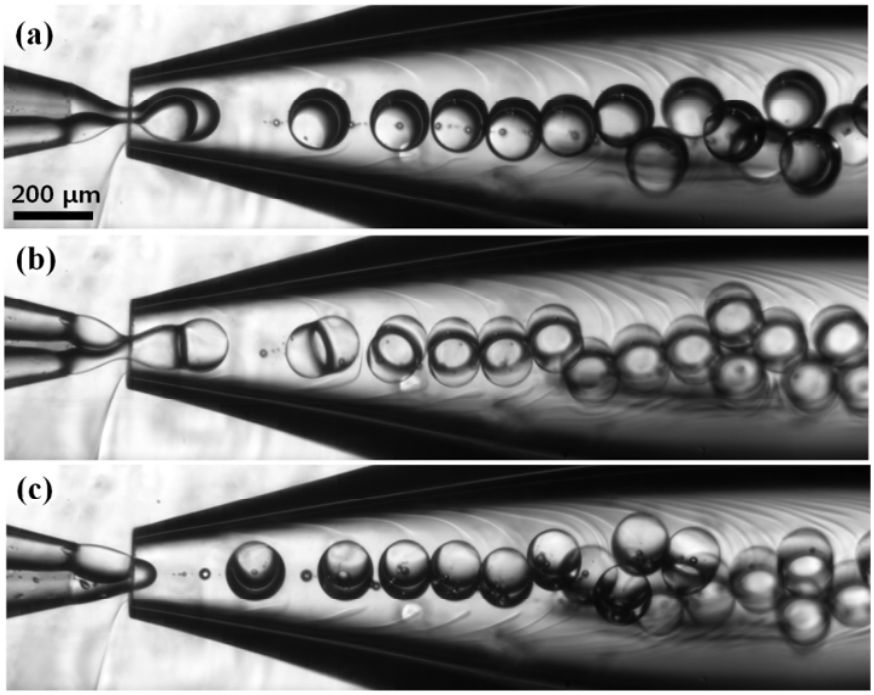

Figure S2. (a-c) Optical microscope images showing generation of double-emulsion drops with (a) single innermost drop covered by a thick shell, (b) two innermost drops covered by a thin shell, and (c) single innermost drops covered by a thick shell.

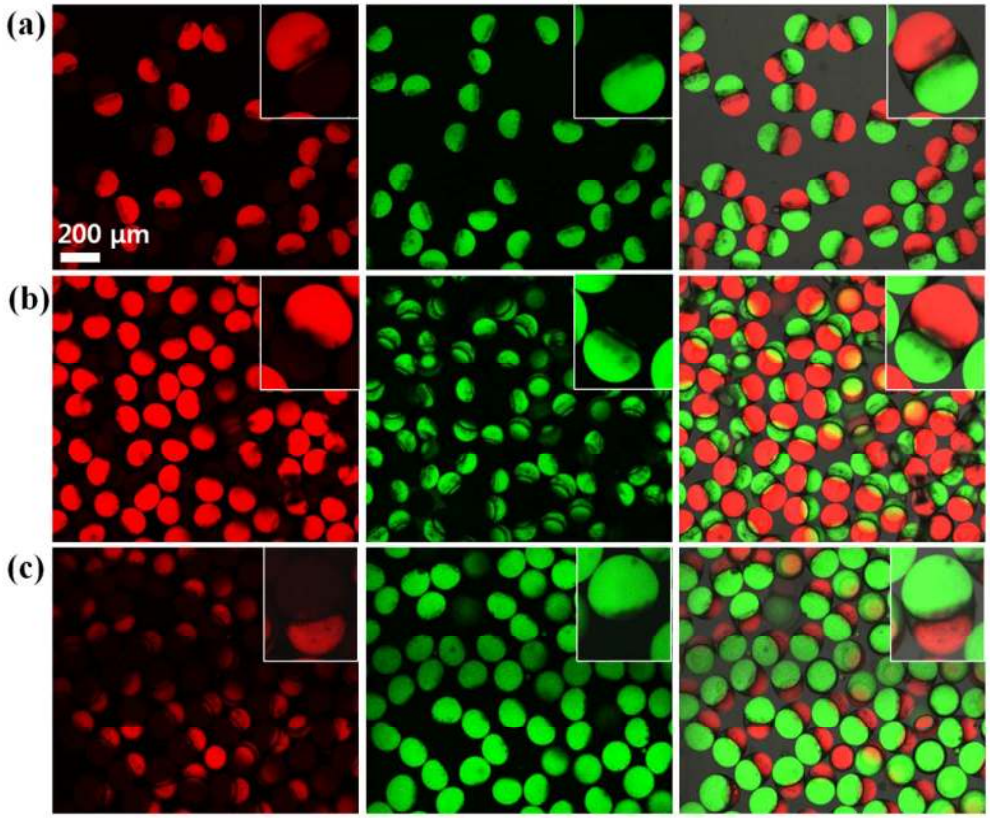

Figure S3. (a-c) Confocal microscope images of (a) symmetric dumbbells and (b-c) asymmetric dumbbells with relative diameters of bulbs of (b) 0.89 of D_{green}/D_{red} and (c) 0.83 of D_{red}/D_{green}.

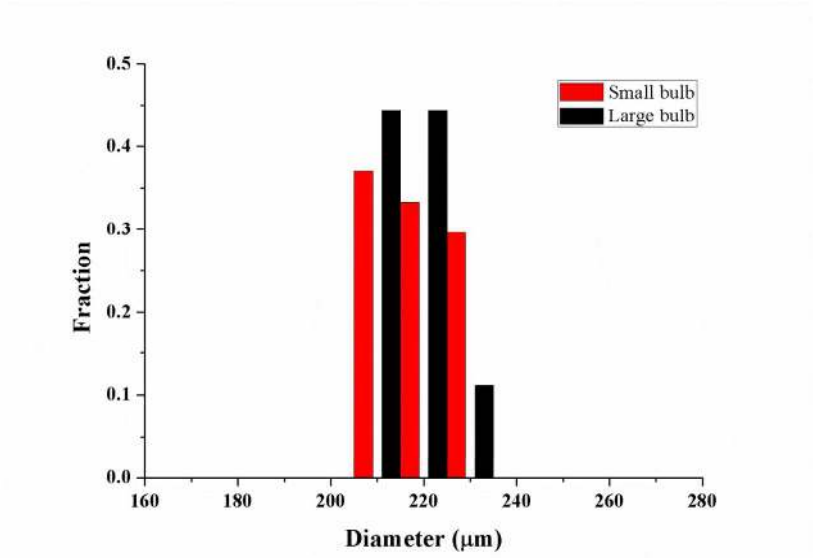

Figure S4. Size distribution of large and small bulbs of dummbells. Coefficients of variation of large and small bulbs are 3.3% and 3.6%, respectively.

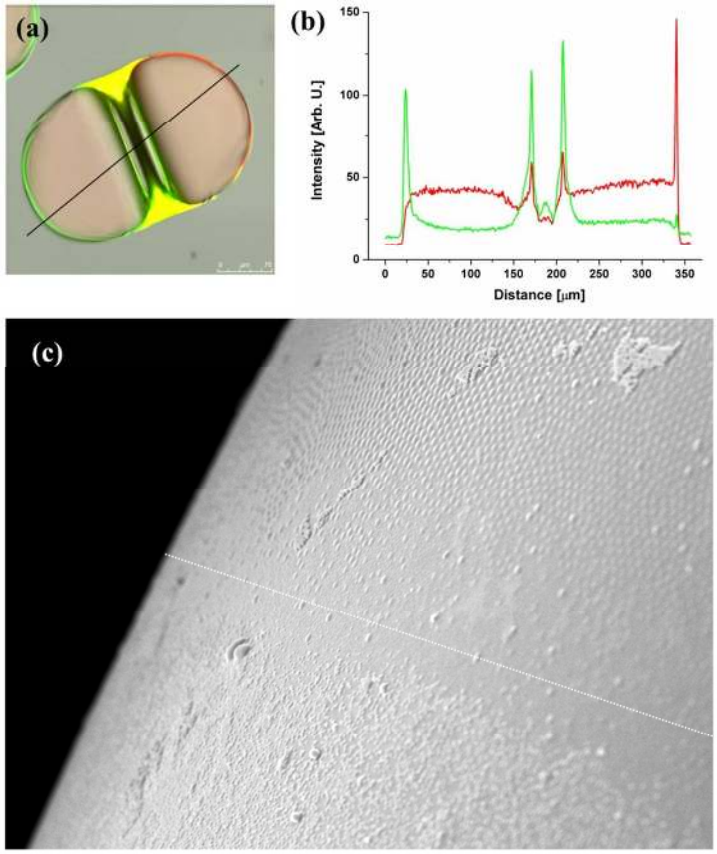

Figure S5. (a) Confocal microscope image of dumbbell-shaped capsules with two distinct membranes of green dye-doped and red dye-doped polymers. (b) Intensity profiles of green and red fluorescence across the line denoted in (a). (c) SEM images of dried microcapsules composed of two distinct membranes: One contains 500 nm silica particles on its surface and the other contains 200 nm silica particles. A boundary between two membranes is denoted by dotted line.

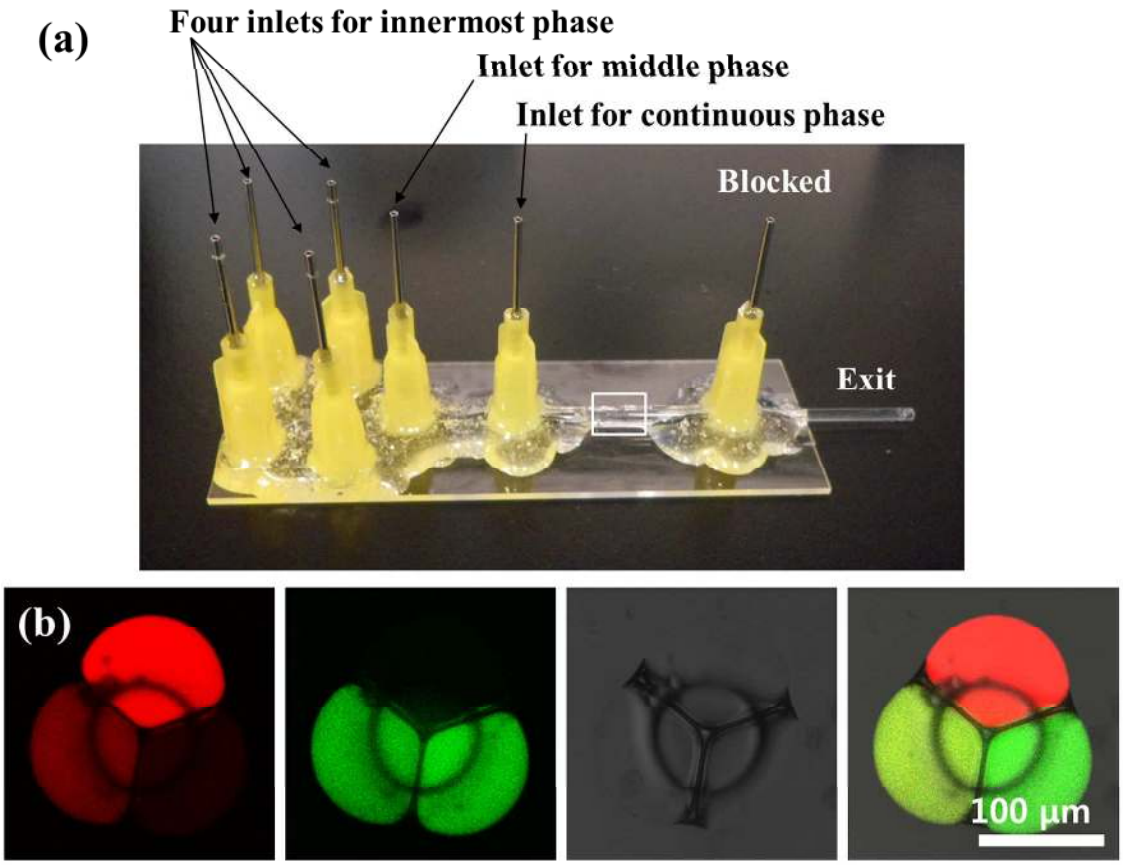

Figure S6. (a) An image of the microfluidic device for preparation of double-emulsion drops with three or four distinct innermost drops. (b) Confocal microscope image of double-emulsion drops in tetrahedron shape whose four innermost drops are covered by an ultra-thin shell.

S2. Description of Movies

- **Movie S1**: Generation of dumbbell-shaped double-emulsion drops with two distinct innermost drops covered by an ultra-thin shell of ETPTA, where flow rates of two inner (Q_{i1} and Q_{i2}), two middle (Q_{m1} and Q_{m2}), and continuous (Q_c) phases are maintained at values of 300 µl/h, 200 µl/h, and 6000 µl/h, respectively.
- **Movie S2**: Effect of relative flow rates, $(Q_{i1}+Q_{m1})/(Q_{i2}+Q_{m2})$, on symmetry of dumbbell-shaped double-emulsion drops.
- **Movie S3**: Generation of spherical double-emulsion drops with single core covered by thin shell with two different domains.