Supporting information

Morphology Mapping of Nanoparticle-filled Immiscible Polymer Blends in Flow: The Existence of a Critical Ratio between Nanoparticle Concentration and Droplet Concentration

Miqiu Kong,[a] Guangling Chen,[b] Shuting Xi,[b] Yajiang Huang,*[b] Guangxian Li*[b]

[a] School of Aeronautics and Astronautics, Sichuan University, Chengdu 610065, PRC

[b] College of polymer science and engineering, State key laboratory of polymer materials engineering of China, Sichuan University, Chengdu 610065, PRC

* Corresponding author. E-mail: hyj@scu.edu.cn (Y. Huang), guangxianli@scu.edu.cn (G. Li).

Initial morphology of hydrophilic silica filled PS-minor blends

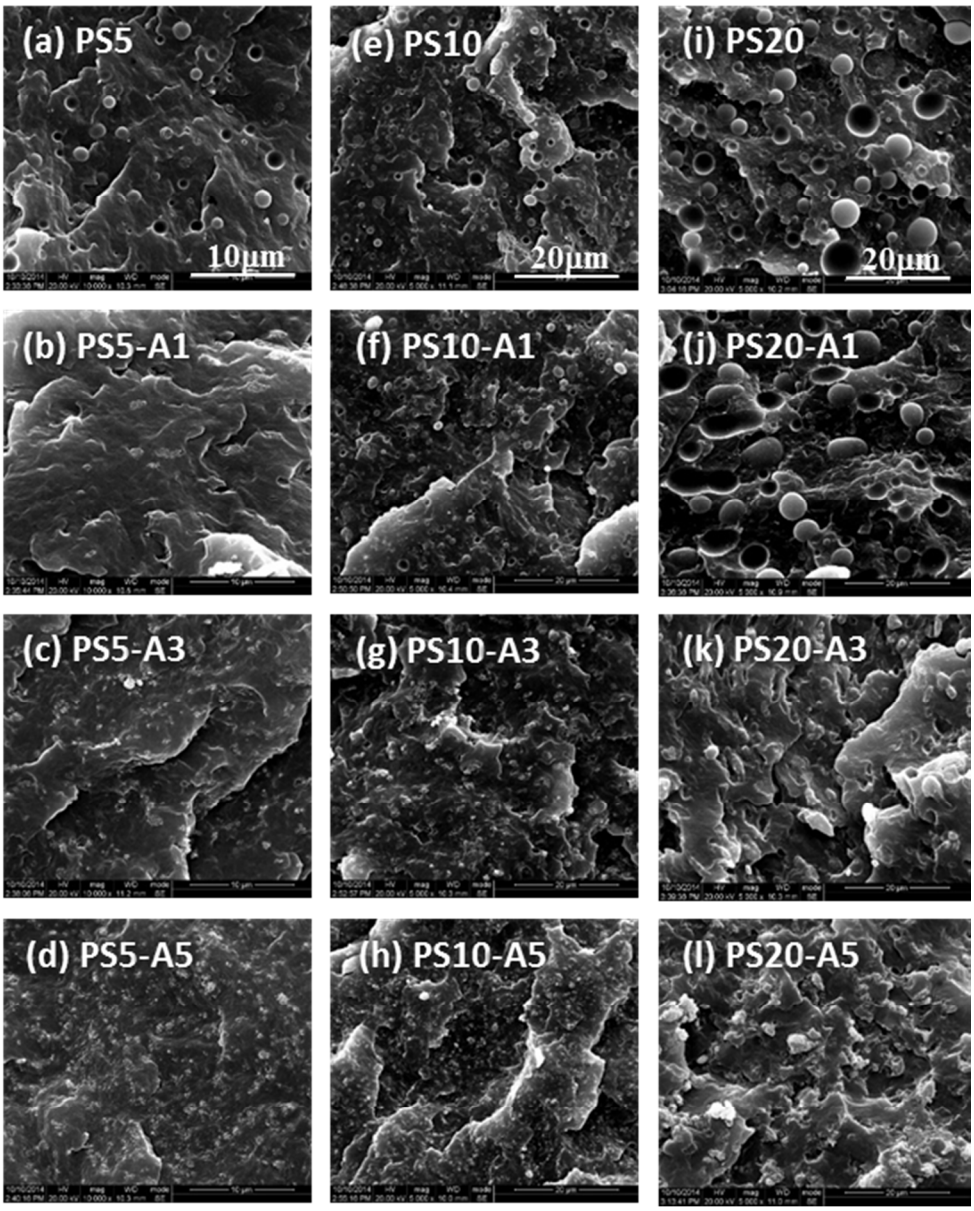

Figure S1 Initial morphology of hydrophilic silica nanoparticle (A200) filled PP/PS blends with **PP as a matrix**: (a-d) PP/PS 95/5 (PS5) blends, (e-h) PP/PS 90/10 (PS10) blends and (i-l) PP/PS 80/20 (PS20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of A200 (A1, A3 and A5) nanoparticles, respectively.

Initial morphology of hydrophobic silica filled PS-minor blends

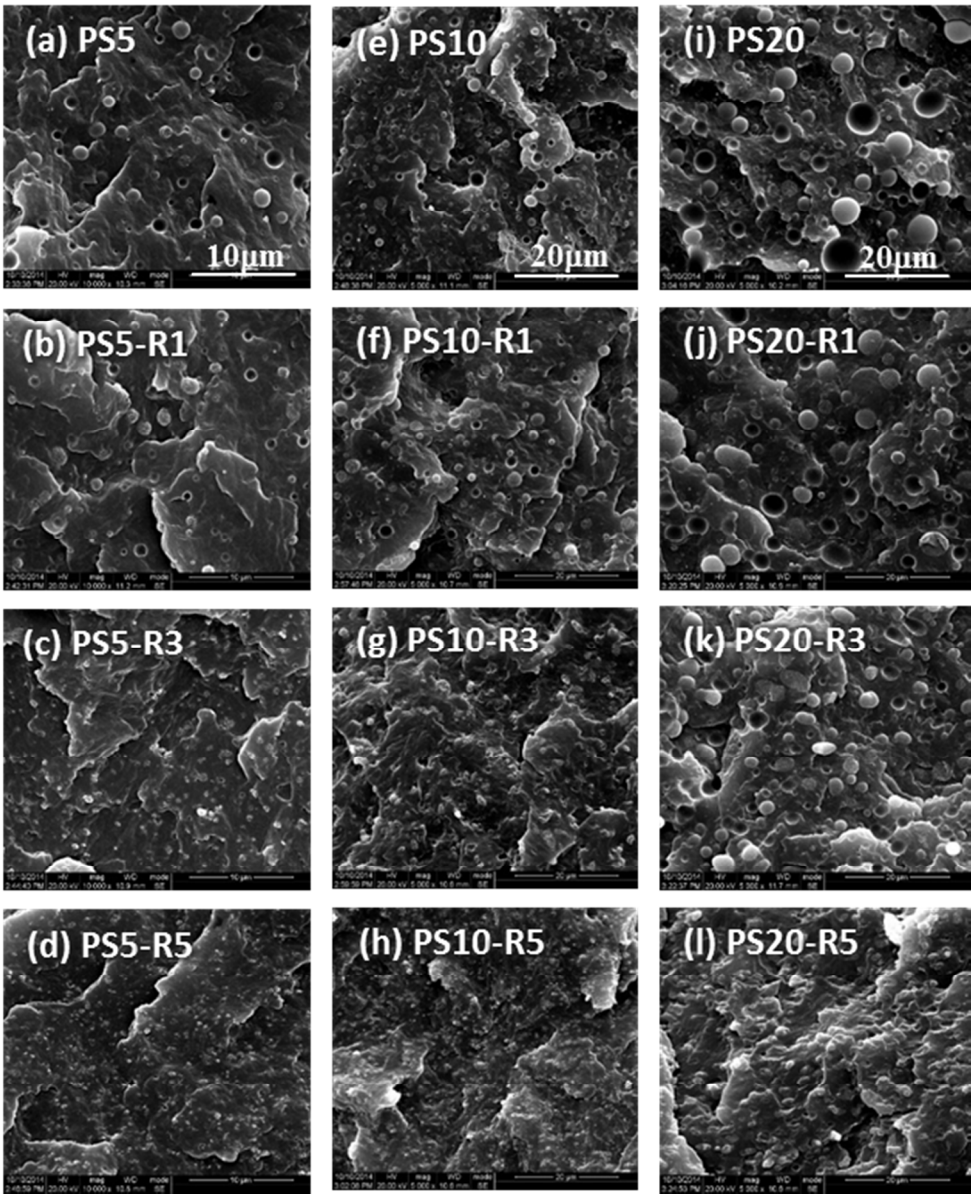

Figure S2 Initial morphology of hydrophobic silica nanoparticle (R974) filled PP/PS blends with **PP as a matrix**: (a-d) PP/PS 95/5 (PS5) blends, (e-h) PP/PS 90/10 (PS10) blends and (i-l) PP/PS 80/20 (PS20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of R974 (R1, R3 and R5) nanoparticles, respectively.

Initial morphology of hydrophilic silica filled PP-minor blends

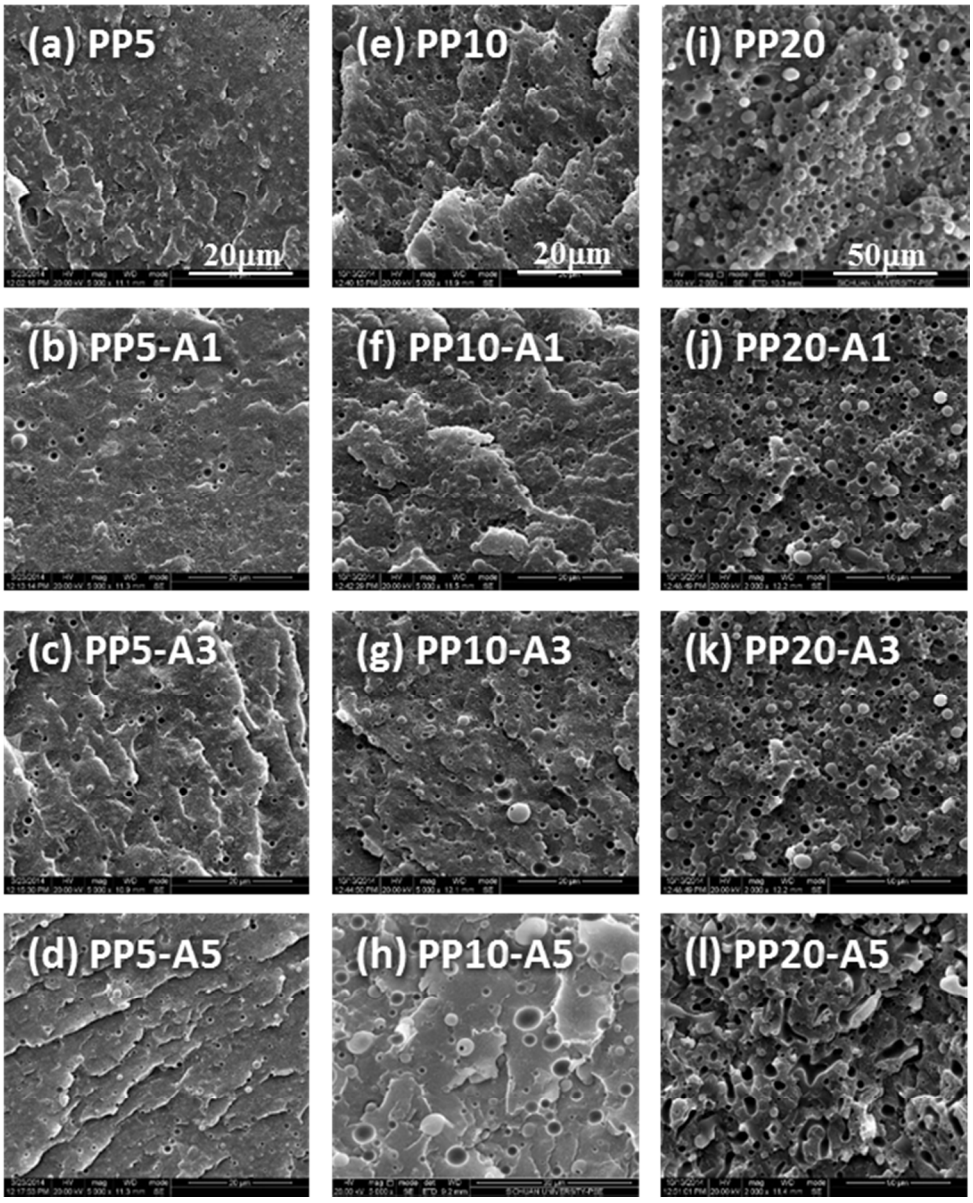

Figure S3 Initial morphology of hydrophilic silica nanoparticle (A200) filled PP/PS blends with **PS as a matrix**: (a-d) PP/PS 5/95 (PP5) blends, (e-h) PP/PS 10/90 (PP10) blends and (i-l) PP/PS 20/80 (PP20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of A200 (A1, A3 and A5) nanoparticles, respectively.

Initial morphology of hydrophobic silica filled PP-minor blends

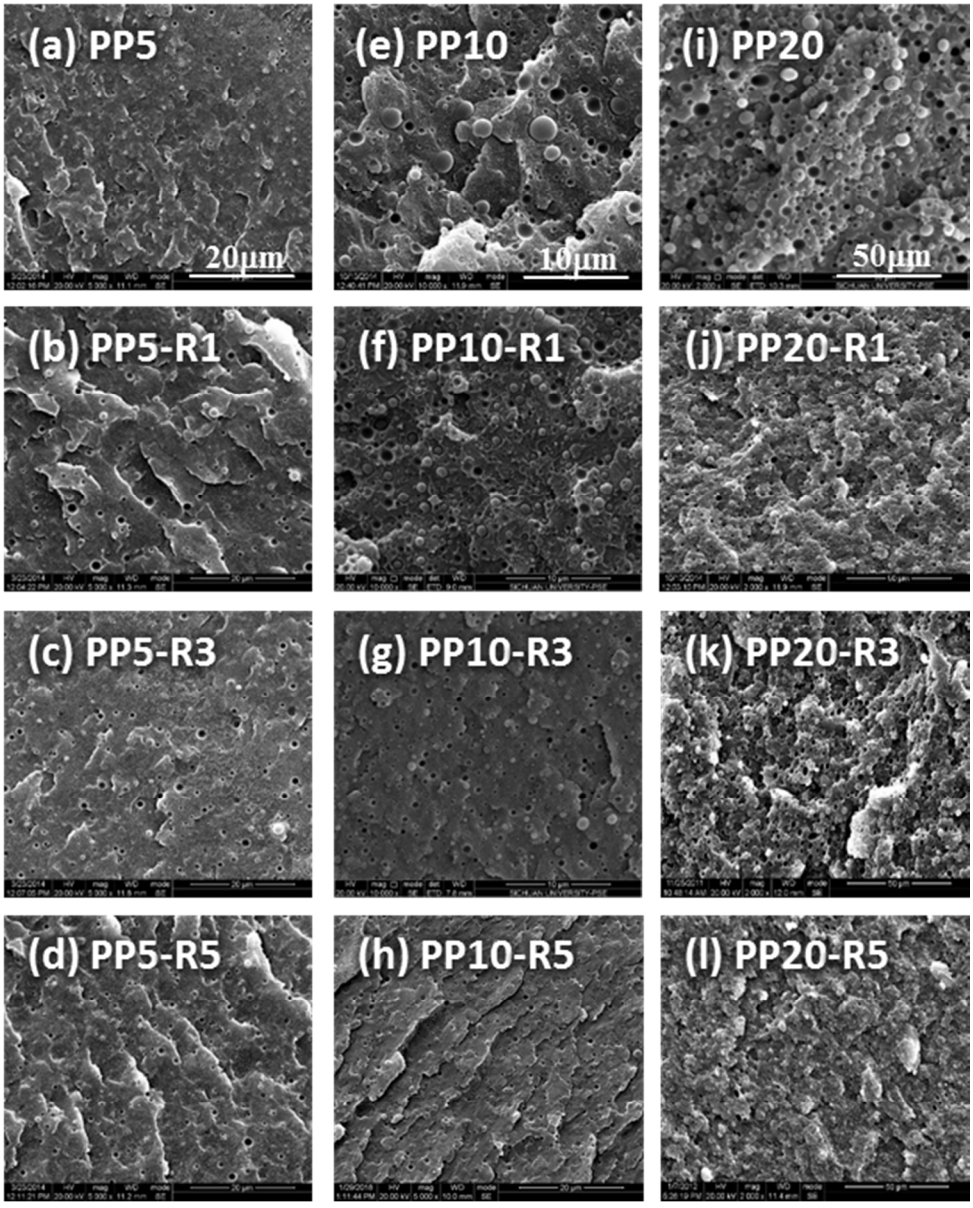

Figure S4 Initial morphology of hydrophobic silica nanoparticle (R974) filled PP/PS blends with **PS as a matrix**: (a-d) PP/PS 5/95 (PP5) blends, (e-h) PP/PS 10/90 (PP10) blends and (i-l) PP/PS 20/80 (PP20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of R974 (R1, R3 and R5) nanoparticles, respectively.

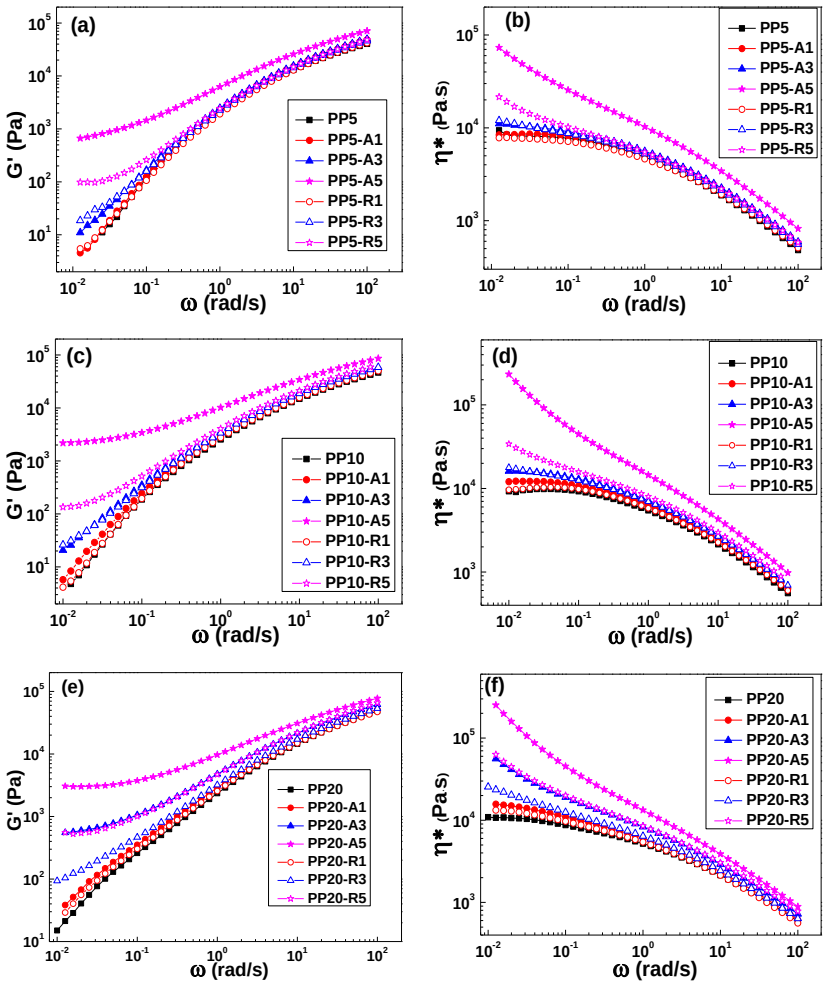

Figure S5 Rheological properties of nanoparticle filled PP/PS blends with **PS as a matrix**: (a-b) PP/PS 5/95 (PP5) blends, (c-d) PP/PS 10/90 (PP10) blends and (e-f) PP/PS 20/80 (PP20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of A200 hydrophilic (A1, A3 and A5) and R974 hydrophobic (R1, R3 and R5) silica nanoparticles, respectively.

Viscoelastic properties of nanoparticle filled PP-minor blends

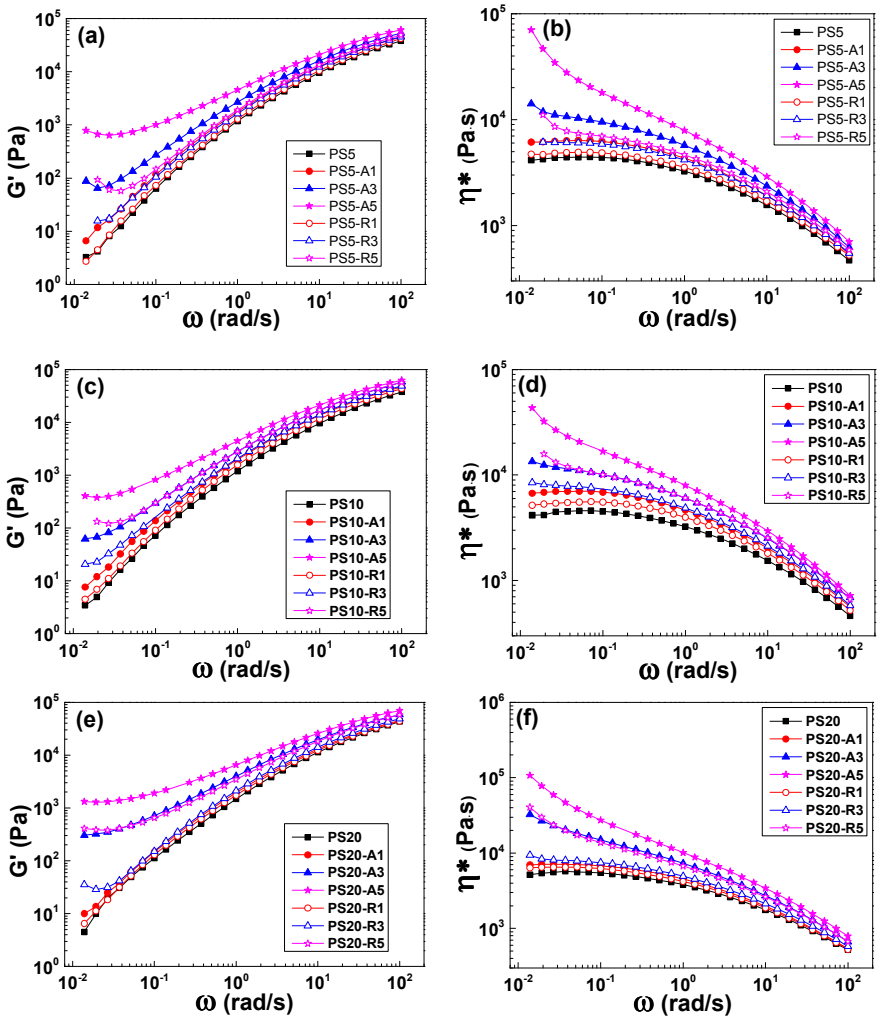

Figure S6 Rheological properties of nanoparticle filled PP/PS blends with **PP as a matrix**: (a-b) PP/PS 95/5 (PS5) blends, (c-d) PP/PS 90/10 (PS10) blends and (e-f) PP/PS 80/20 (PS20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of A200 hydrophilic (A1, A3 and A5) and R974 hydrophobic (R1, R3 and R5) silica nanoparticles, respectively.

Morphology of hydrophilic silica filled PS-minor blends after shearing

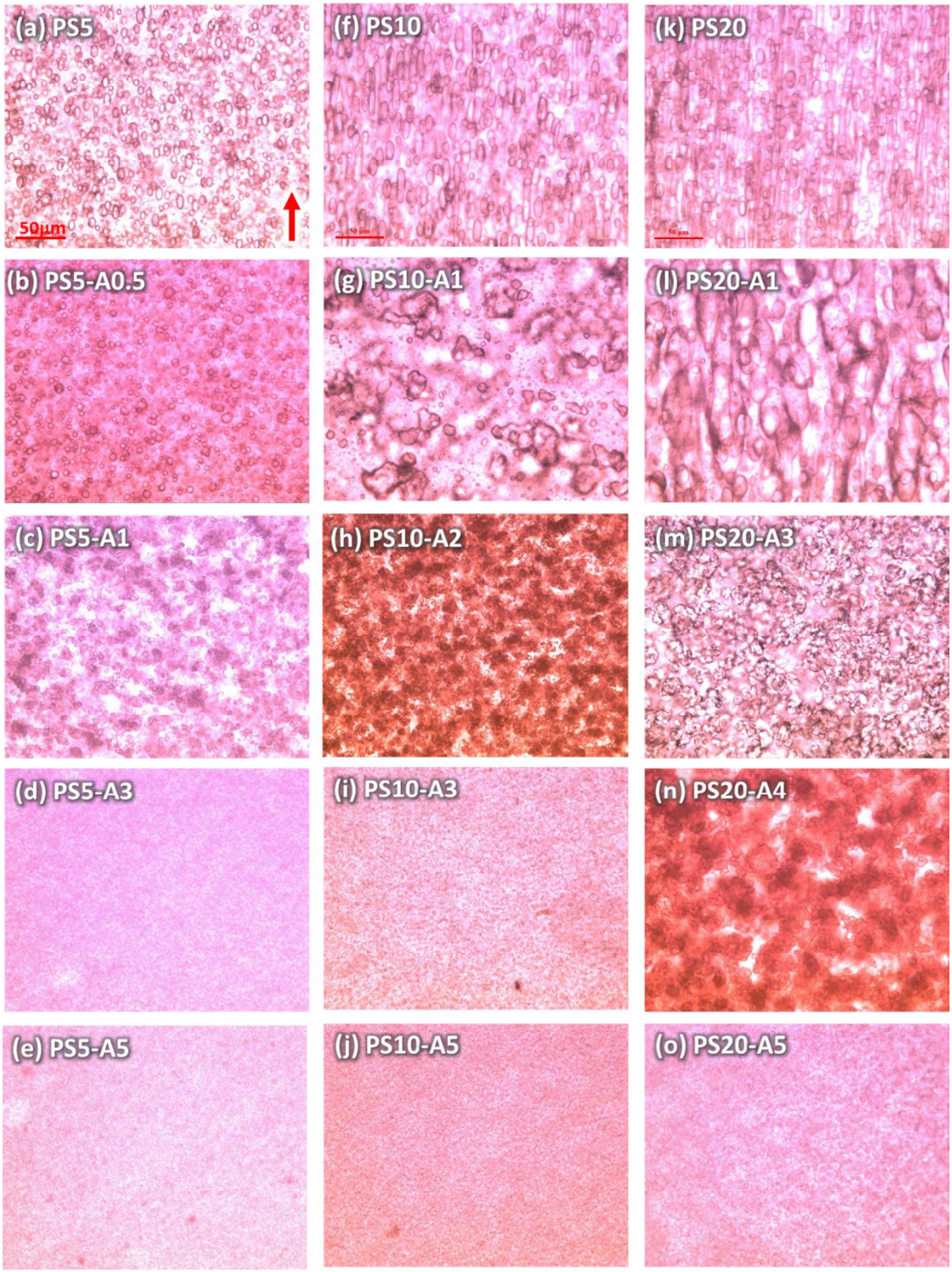

Figure S7 Optical micrographs of hydrophilic silica nanoparticle (A200) filled PP/PS blends with PP as a

matrix: (a-e) PP/PS 95/5 (PS5) blends, (f-j) PP/PS 90/10 (PS10) blends and (k-o) PP/PS 80/20 (PS20) blends unfilled and filled with different concentrations (0.5, 1, 3 and 5 wt.%) of A200 (A0.5, A1, A3 and A5) nanoparticles after shearing at 0.1 s^{-1} and 200 °C for 7000 s, respectively. For these blends, the ratio of A200 NP concentration to PS concentration is varied from 0.05 to 1.0. The scale bar denotes 50 μm for all images. The red arrow represents the direction of shear flow.

Morphology of hydrophilic silica filled PP-minor blends after shearing

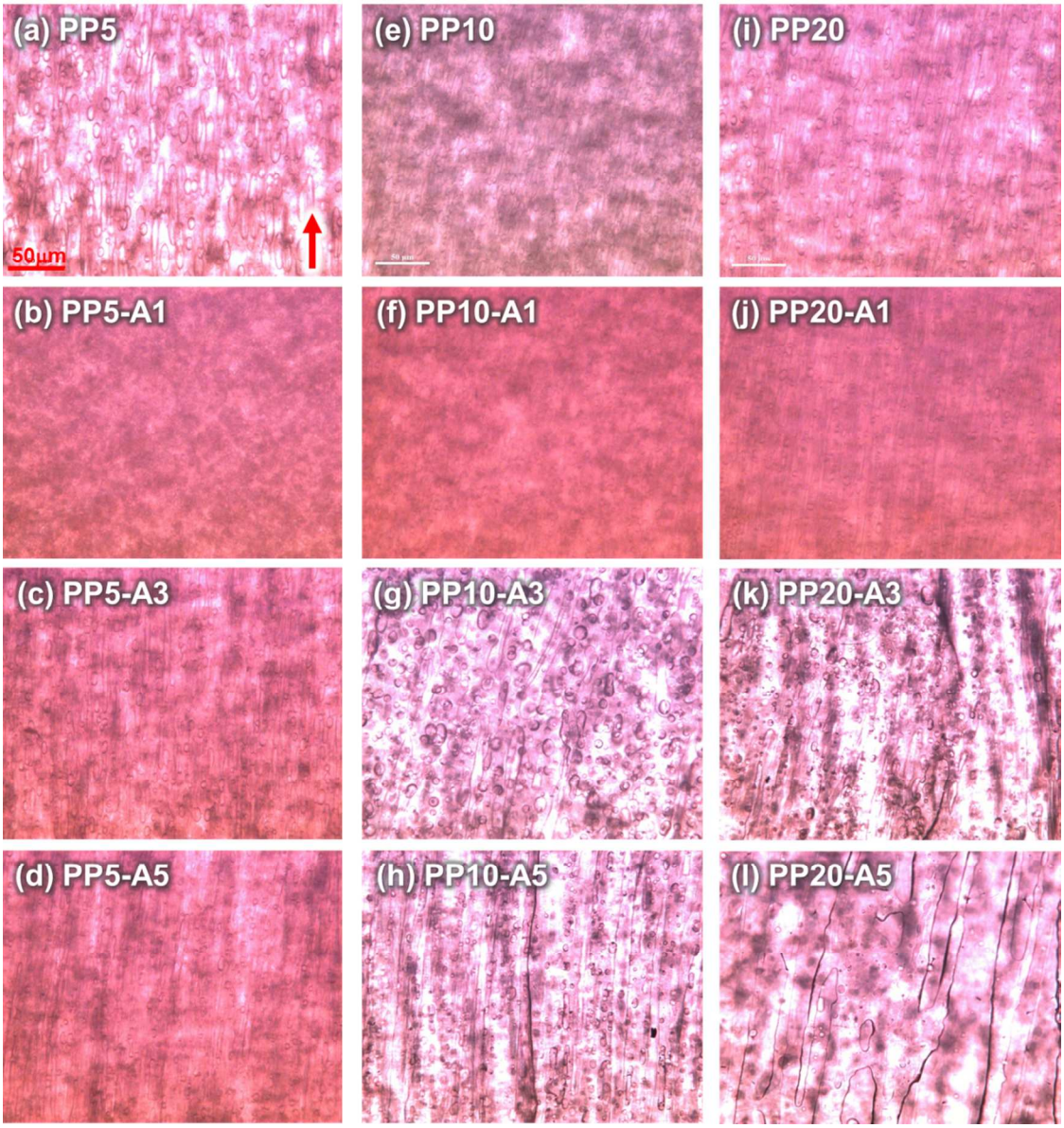

Figure S8 Optical micrographs of hydrophilic silica nanoparticle (A200) filled PP/PS blends with PS as a matrix: (a-d) PP/PS 5/95 (PP5) blends, (e-h) PP/PS 10/90 (PP10) blends and (i-l) PP/PS 20/80 (PP20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of A200 (A1, A3 and A5) nanoparticles after shearing at 0.1 s^{-1} and 200 °C for 7000 s, respectively. The scale bar denotes 50 μm for all images. The red

arrow represents the direction of shear flow.

Morphology of hydrophobic silica filled PS-minor blends after shearing

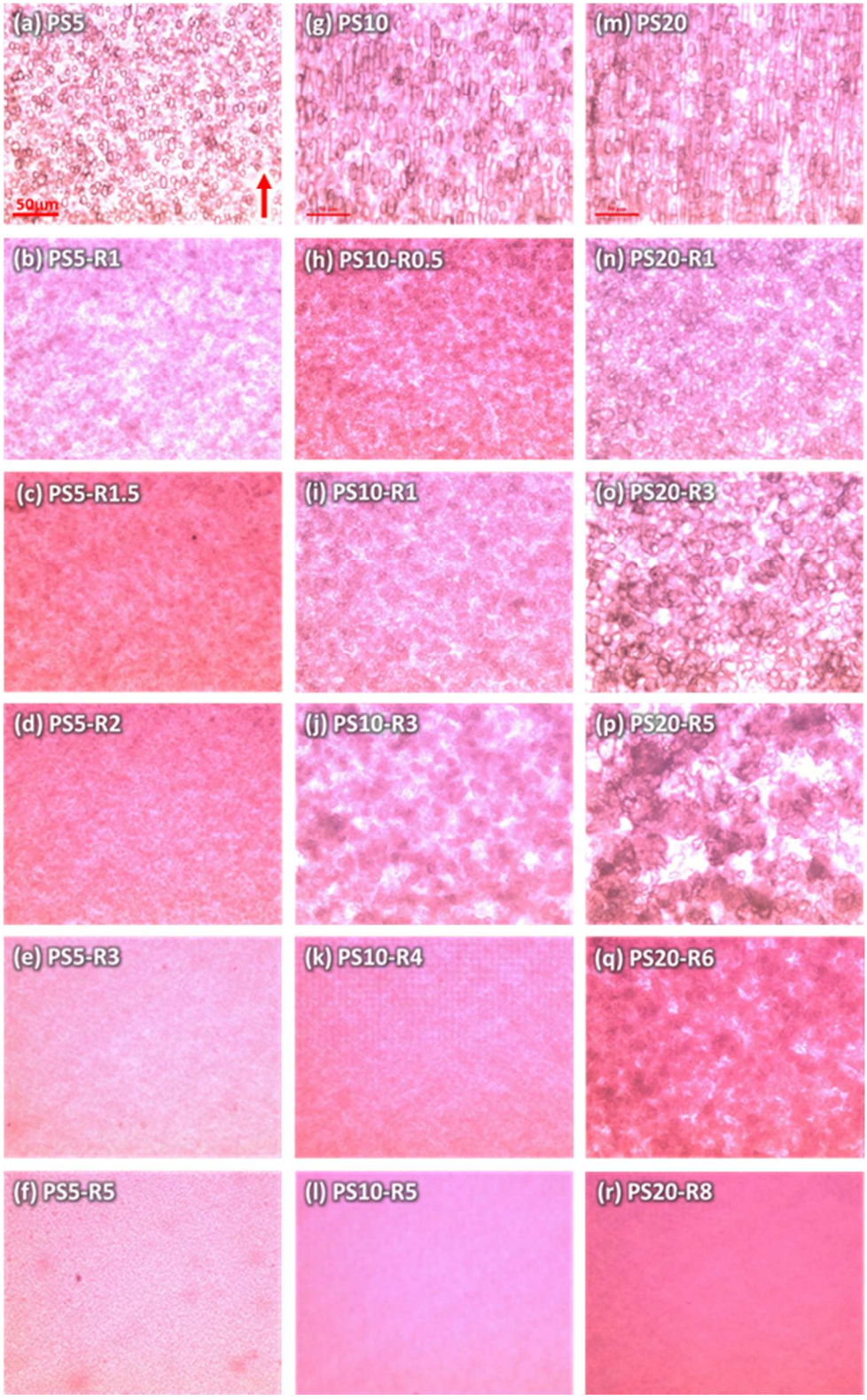

Figure S9 Optical micrographs of hydrophobic silica nanoparticle (R974) filled PP/PS blends with PP as a matrix: (a-f) PP/PS 95/5 (PS5) blends, (g-l) PP/PS 90/10 (PS10) blends and (m-r) PP/PS 80/20 (PS20) blends unfilled and filled with different concentrations (0.5, 1, 1.5, 3, 4, 6 and 8 wt.%) of R974 (R0.5, R1, R1.5, R3, R4, R6 and R8) nanoparticles after shearing at 0.1 s^{-1} and 200 °C for 7000 s, respectively in which the ratio of R974 NP concentration to PS concentration is varied from 0.05 to 1.0. The scale bar denotes 50 μm for all images. The red arrow represents the direction of shear flow.

Morphology of hydrophobic silica filled PP-minor blends after shearing

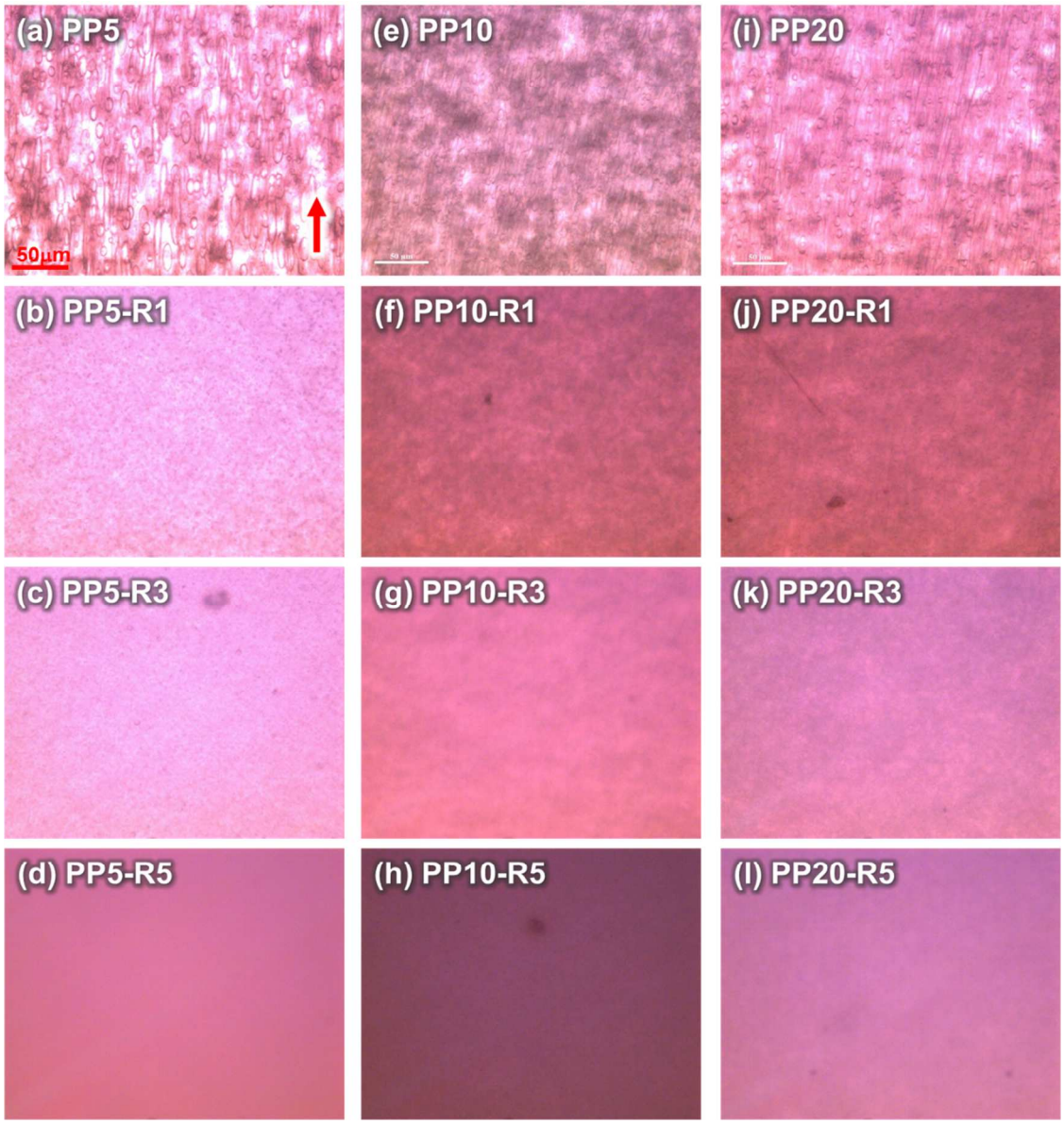

Figure S10 Optical micrographs of hydrophobic silica nanoparticle (R974) filled PP/PS blends with PS as a matrix: (a-d) PP/PS 5/95 (PP5) blends, (e-h) PP/PS 10/90 (PP10) blends and (i-l) PP/PS 20/80 (PP20) blends unfilled and filled with different concentrations (1, 3 and 5 wt.%) of R974 (R1, R3 and R5) nanoparticles after shearing at 0.1 s^{-1} and 200 °C for 7000 s, respectively. The scale bar denotes 50 µm for all images. The red arrow represents the direction of shear flow.

Droplet size of hydrophobic silica filled PP-minor blends after shearing

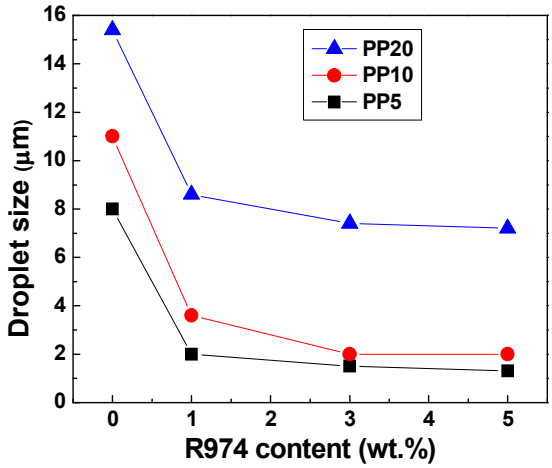

Figure S11 Dependence of the droplet size in PP/PS blends on the R974 loadings after shearing at 200 °C and 0.1 s^{-1} for 7000 s.