Supplementary Information

Tuning Structural Motifs and Alloying of Bulk Immiscible Mo-Cu Bimetallic Nanoparticles by Gas-Phase Synthesis.

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A. Target configuration



Figure 1.Showing the section target of Mo-Cu used for the production of nanoparticles.

B. Nanoparticle deposition source



Figure 2. Showing the schematic of the nanoparticle production set up (Mantis deposition Ltd).

C. Nanoparticle Synthesis Condition

Current (A)	GasFlow Rate(sccm)	shape	Structure	Aperture Size (mm)	Figures in the Manuscript
0.250	40	Cube	Alloy	3	Figure 1
0.250	70	Spherical	Alloy	3	Figure 1
0.350	40	Cube+Spherical	Core-Shell	3	Figure 2
0.550	40	Spherical	Onion/Multishell	3	Figure 4
0.550	100	Spherical	Core-Shell	3	Figure 6
0.550	150	Spherical +cube	Janus/ Dumbbell	5.5	Figure 7

Low gas flow	0-40 sccm
Medium gas flow	40-80 sccm
High gas flow	>80 sccm.

Table 1.The table (upper) shows the various parameters involved in the synthesis of various structural motifs of Mo-Cu bimetallic nanoparticles. (b) The table (bottom) shows the gas flow rates stated in the manuscript.



Figure 3. Shows the bright field TEM image of the Mo-Cu alloy NPs. (a) Mo-Cu alloy NPs with a size distribution of 5 ± 3 nm. (b) Mo-Cu alloy nanoparticles produced with an average composition of Mo 75.6 ± 1 at% and Cu 24.4 ± 1 at% showing the NP size distribution of 20 ± 2 nm. (c) Mo-Cu alloy nanoparticles produced with an average composition of 70 ± 1 at.% Mo and 30 ± 1 at.% Cu showing nanoparticle size distribution of 16 ± 2 nm.



Figure 4.Showing Mo/Cu core/shell nanoparticles in two different magnifications with the same composition and size range of the Mo–Cu alloy nanoparticles shown in figure 1 of the manuscript.



Figure 5.(a) HRTEM image of the Mo-Cu-Mo onion structure (b) FFT of the image showing the presence of pure Cu along with pure Mo.



Figure 6.(a) Bright field image of the Mo-Cu NPs in the intermediate stage of forming a completely phase separated janus structure. Inset shows the NP at high magnification. (b) HRTEM image showing the lattice spacing of Cu d (111) and Mo d (110) as a separated Janus structure.