

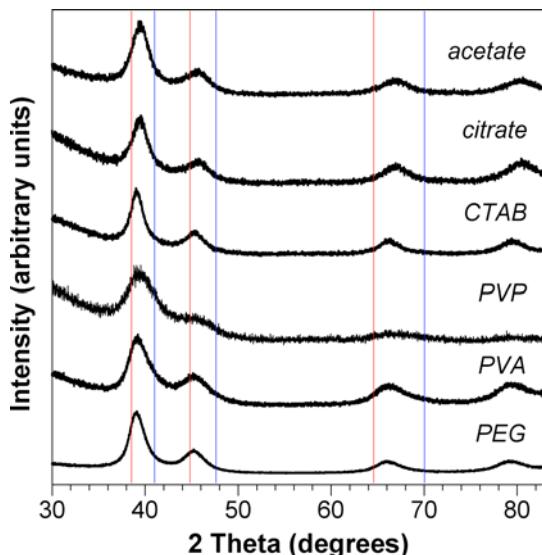
## SUPPORTING INFORMATION

# Aqueous room-temperature synthesis of Au-Rh, Au-Pt, Pt-Rh, and Pd-Rh alloy nanoparticles: Fully tunable compositions within the miscibility gaps

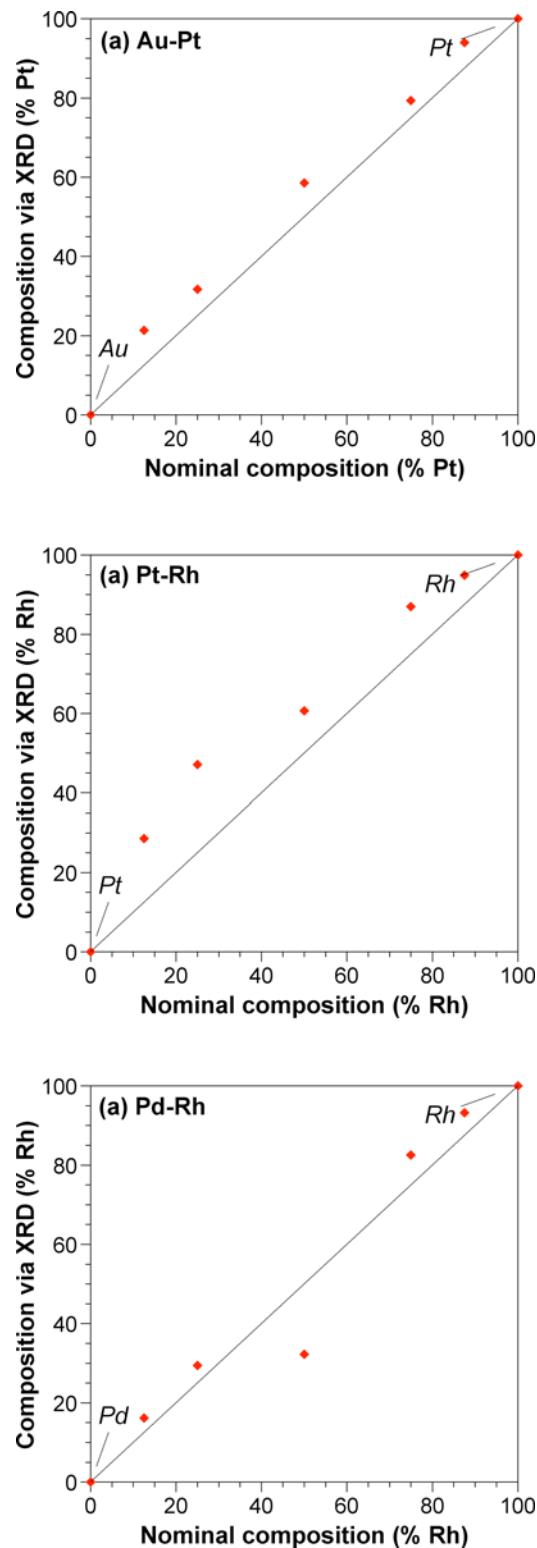
Elizabeth R. Essinger-Hileman, Danielle DeCicco, James F. Bondi, and Raymond E. Schaak\*

*Department of Chemistry and Materials Research Institute, The Pennsylvania State University, University Park, Pennsylvania 16802*

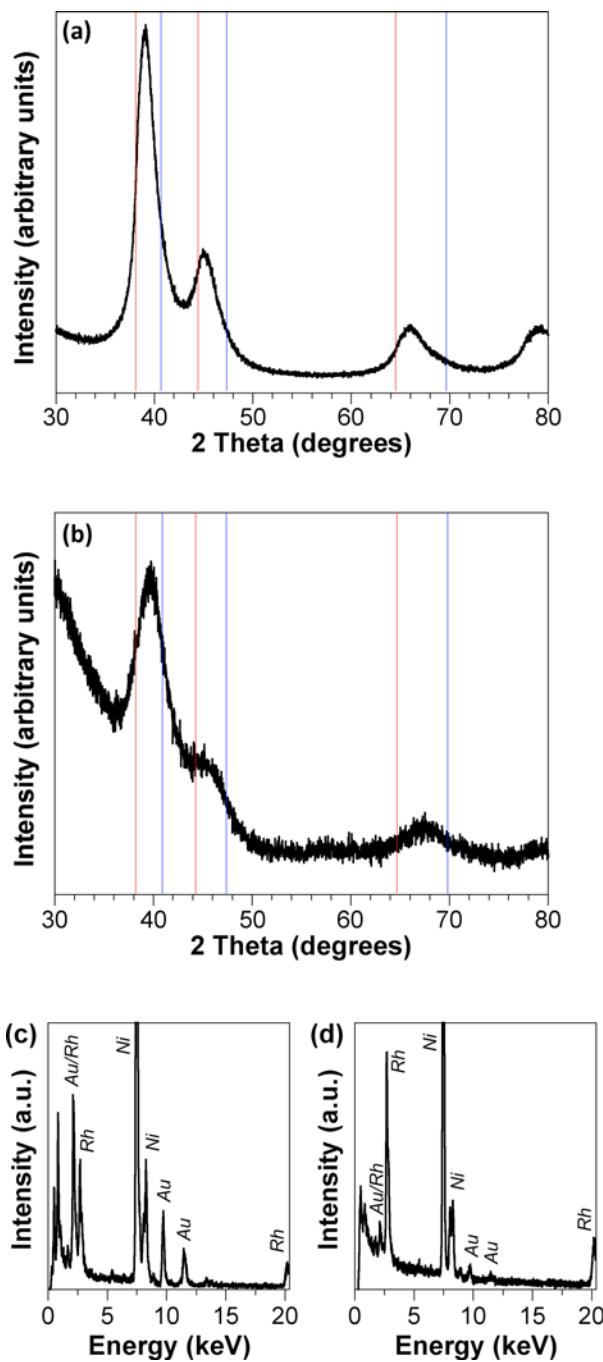
## Additional Table and Figures



**Figure S1.** Powder XRD patterns for Au-Rh alloy nanoparticles synthesized with different polymeric and molecular stabilizers. All nominal Au:Rh compositions were 1:1 except for CTAB (2:3) and PVP (1:2). Vertical lines indicate the (111), (200), and (220) peak positions (left to right) for Au (red) and Rh (blue).



**Figure S2.** Plots of estimated composition (via Vegard's Law analysis of the powder XRD data) vs. nominal composition for (a) Au-Pt, (b) Pt-Rh, and (c) Pd-Rh alloy nanoparticles. The lines represent the ideal direct 1:1 correlation between estimated and nominal composition.



**Figure S3.** Powder XRD patterns for Au-Rh nanoparticles anchored on (a) Vulcan carbon and (b) wild-type M13 bacteriophage. Vertical lines indicate the (111), (200), and (220) peak positions (left to right) for Au (red) and Rh (blue). EDS spectra are shown for (c) Au-Rh (1:1 nominal) on Vulcan carbon and (d) Au-Rh (1:2 nominal) on M13 bacteriophage.

**Table S1.** Volumes of reagent solutions

Alloy	Ratio	$\mu\text{L}$ of 50 mM solution			
		$\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$	$\text{RhCl}_3 \cdot x\text{H}_2\text{O}$	$\text{K}_2\text{PtCl}_4$	$\text{PdCl}_2$
Au:Rh	10:1	909	91	-	-
	7:1	875	125	-	-
	5:1	833	167	-	-
	3:1	750	250	-	-
	2:1	667	333	-	-
	5:3	625	375	-	-
	1:1	500	500	-	-
	3:5	375	625	-	-
	1:2	333	667	-	-
	1:3	250	750	-	-
	1:5	167	833	-	-
	1:7	125	875	-	-
	1:10	90	909	-	-
Au:Pt	7:1	875	-	125	-
	3:1	750	-	250	-
	1:1	500	-	500	-
	1:3	250	-	750	-
	1:7	125	-	875	-
PtRh	7:1	-	125	875	-
	3:1	-	250	750	-
	1:1	-	500	500	-
	1:3	-	750	250	-
	1:7	-	875	125	-
PdRh	7:1	-	125	-	875
	3:1	-	250	-	750
	1:1	-	500	-	500
	1:3	-	750	-	250
	1:7	-	875	-	125