Supplementary Information

Expanding the Range: AuCu Metal Aerogels from H_2O and EtOH

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Table S1. Properties of all Au_xCu_y aerogels prepared via a synthesis in H_2O and EtOH. Element compositions were determined via SEM-EDX, the average web thicknesses were determined from individual measurements of the TEM images and SSA/TpV via N_2 physisorption.

Solvent	Sample	Element composition [at%]			Web Thickness [nm]	SSA [m^2g^{-1}]	TpV [cm^3g^{-1}]
		Au	Cu	Standard Deviation			
H_2O	Au_3Cu	73.4	26.6	0.7	3.2 ± 0.8	56	0.121
	AuCu	49.9	50.1	1.9	2.8 ± 0.6	59	0.140
	$AuCu_3$	24.9	75.1	1.6	2.5 ± 0.7	59	0.213
	AuCu AW	62.0	38.0	2.5	2.9 ± 0.7	71	0.186
	$AuCu_3$ AW	62.2	37.8	2.5	2.7 ± 0.7	69	0.226
EtOH	Au_3Cu	76.0	24.0	1.0	6.7 ± 1.3	28	0.122
	AuCu	52.0	48.0	0.8	7.1 ± 1.5	40	0.294
	$AuCu_3$	26.9	73.2	0.3	7.0 ± 1.5	64	0.490
	Cu	-	-	-	6.6 ± 1.6	43	0.101

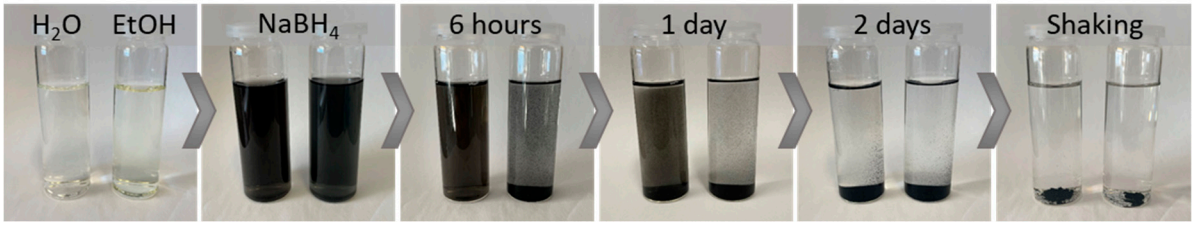

Figure S1. Time lapse photographs of the Au_3Cu solvogel gelation process in water (left) and ethanol (right). The metal salt solutions turn dark upon $NaBH_4$ addition. The intermediately formed aggregates settle at different rates and form gels.

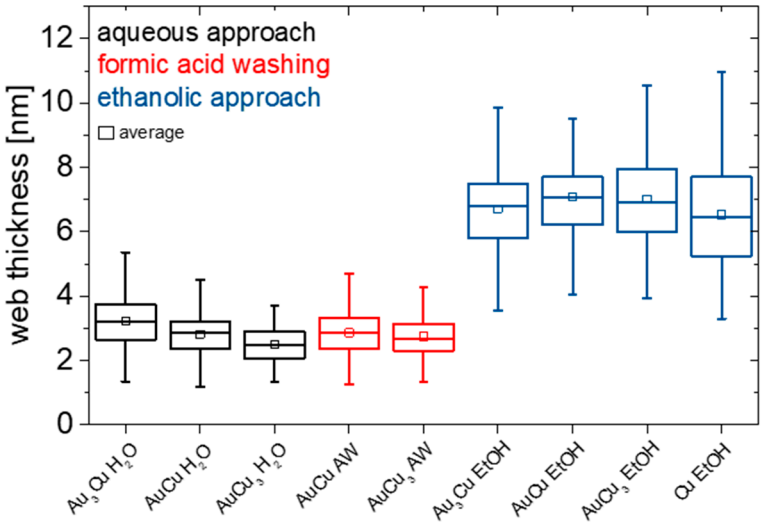

Figure S2. Overview of the web thicknesses and their size distribution of all prepared Au_xCu_y aerogels, determined from bright-field TEM images and visualized in form of boxplots. The average web thickness of the gels prepared in aqueous solution is 3 nm, while that of the gels obtained in ethanolic solution is about 6 nm. In EtOH, the web thickness' size distribution becomes broader.

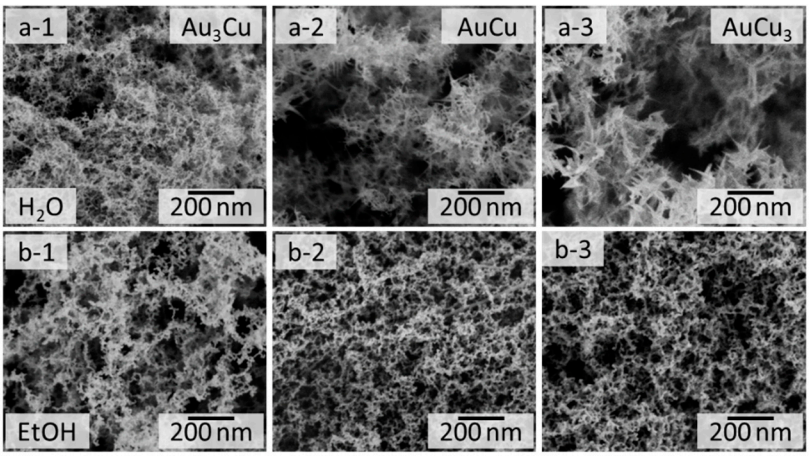

Figure S3. SEM images of Au_3Cu (1), AuCu (2), and $AuCu_3$ (3) aerogels from an aqueous (a) and ethanolic (b) synthesis. The aerogels form three-dimensional, porous networks. In a-2 and a-3 the gels are covered with a needle-like substructure.

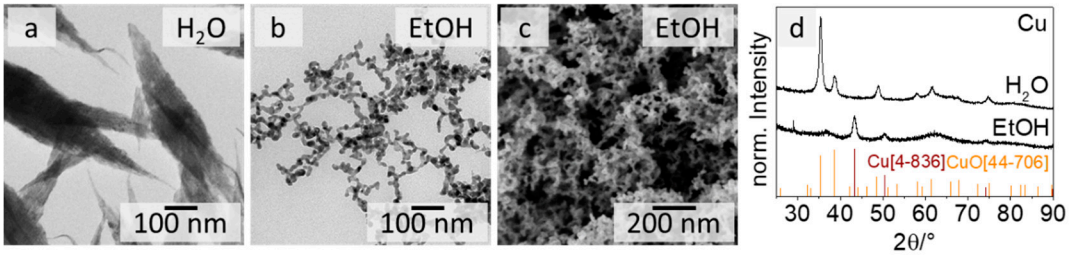

Figure S4. TEM (a + b) and SEM (c) images as well as XRD analysis (d) of reduced $CuCl_2$, following the synthesis parameter of the Au-Cu gels. In water (a) the reaction leads to the formation of CuO-needles (d). In EtOH the formation of a three-dimensional Cu aerogel (b + c) can be observed. The gel keeps its metallic character and an additional CuO phase (d).

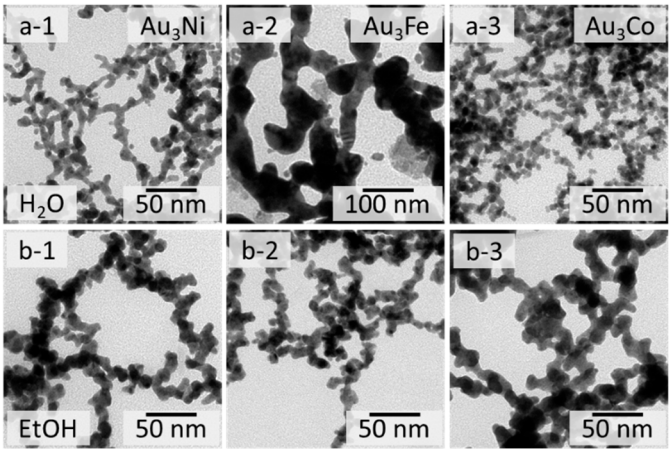

Figure S5. TEM images of Au_3Ni (1), Au_3Fe (2) and Au_3Co (3) gels, synthesized in H_2O (a) and EtOH (b). The synthesis results in irregular gel structures in water, while similar gel morphologies are obtained in ethanol.

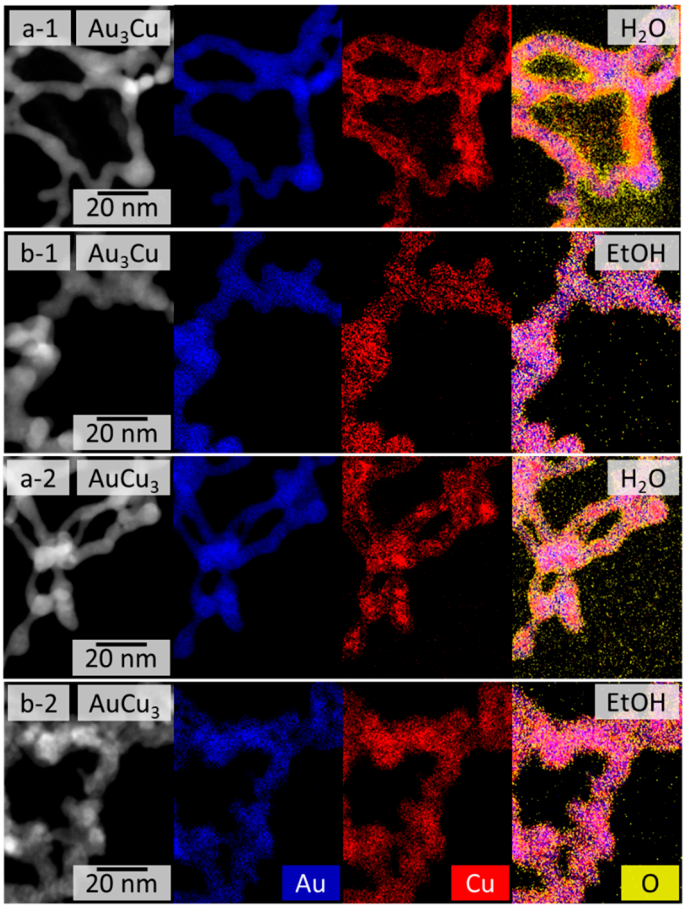

Figure S6. HAADF-STEM images (left) and EDX-based element distributions of the Au_3Cu (1) and $AuCu_3$ (2) gels synthesized in water (a) and ethanol (b). The gels demonstrate a quite homogeneous distribution of Au and Cu over the whole gel networks.

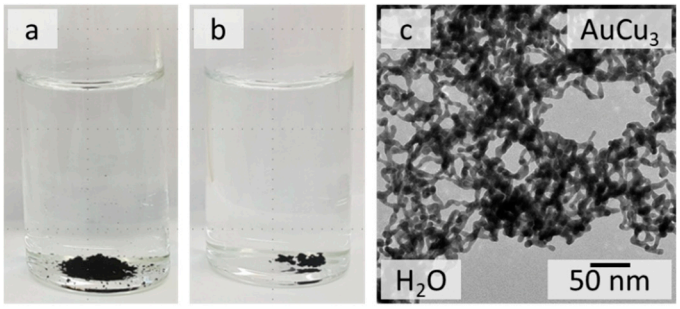

Figure S7. $AuCu_3$ gel before (a) and after (b) the acid treatment in a 88.5 mM formic acid solution. TEM image (c) of the acid-treated gel. The treatment leads to a macroscopic shrinkage of the structure and an increase of the web thickness.

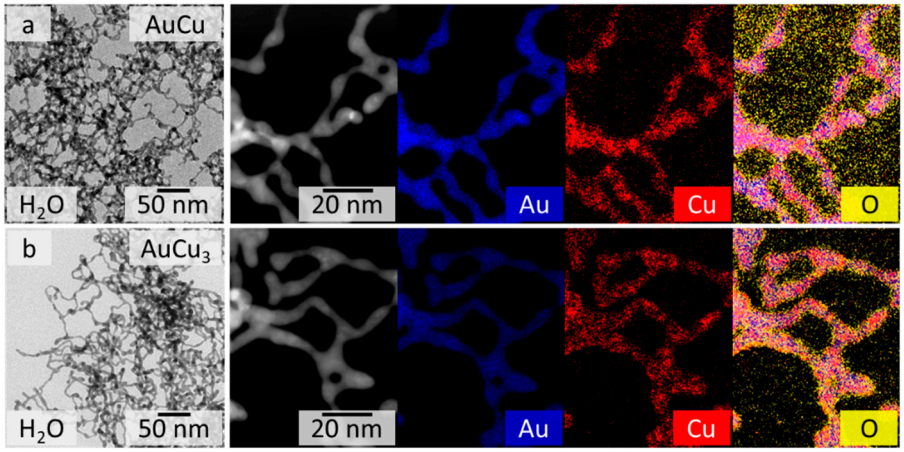

Figure S8. TEM micrographs as well as HAADF-STEM images and EDX-based element distributions of the AuCu (a) and $AuCu_3$ (b) gels from the aqueous approach after the acid treatment with HCOOH. CuO is not observable and the gel network remains untouched. Cu can still be found in the gel strands.

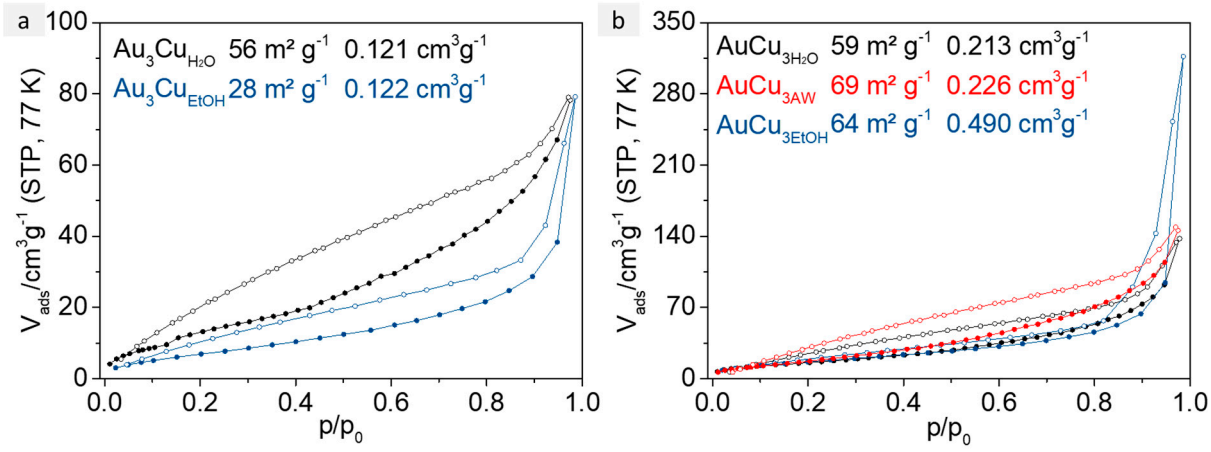

Figure S9. N_2 physisorption isotherms of Au_3Cu (a) and $AuCu_3$ (b) aerogels synthesized in water (black), after acid treatment with HCOOH (red) and synthesized in EtOH (blue). All isotherms are combinations of type II and IV, indicating broad pore size distributions.