Supporting Information

Continuous Microfluidic Synthesis of Colloidal Ultrasmall Gold Nanoparticles: In situ Investigation of the Early Reaction Stages and Application for Catalysis

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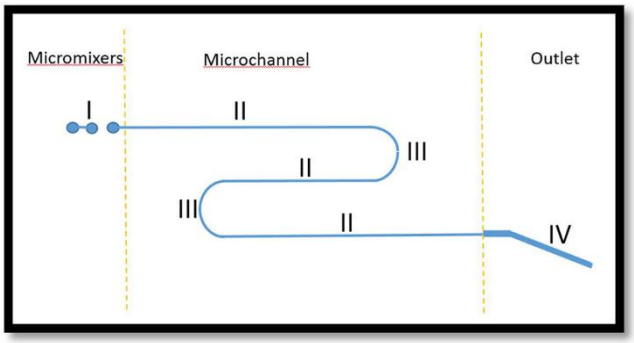

Fig. S1 Schematic of the microfluidic chip.

Table S1 Pressure drop of the reactant flow inside the microfluidic chip at different positions (cf. Fig. S1) estimated with water as the medium, 20°C temperature, 2.6 L h^{-1} flow rate and 13 bar pressure.

Zone	Description	Dimensions (mm)			Pressure drop (bar)
		W	H	L	
I	Micromixers with connections	-	-	-	4.1[a]
II	Rectangular tubes	0.3	0.3	138	7.5[b]
III	U-turns	0.3	0.3	7	0.8[b]
IV	Rectangular tubes	1	1	12	0
Total pressure drop					12.4

[a)] obtained from CFD calculations conducted at IMVT-KIT, [b)] calculated using the program "Druckverlust Online-Rechner", http://www.druckverlust.de/Online-Rechner/)

Table S2 Fluid mechanical conditions inside the microfluidic chip.

Parameters	Values
Medium	Water
Density	998.2 kg m^{-3}
Dynamic viscosity (20 °C)	1.00 mPas
Flow rate	2.6 L h^{-1}
Flow velocity	8.04 m s^{-1}
Reynolds number	2400
Flow type	Transitional region from laminar to turbulent flow
Pressure drop	12.4 bar

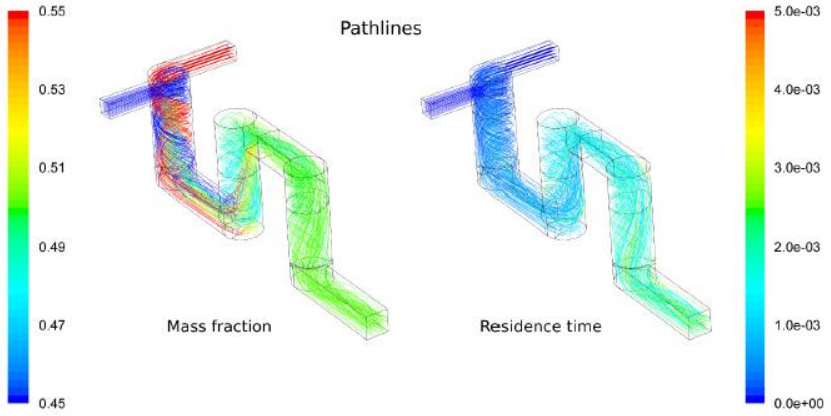

Fig. S2 CFD calculations for the three cyclone micromixers; (left) mass fraction and (right) residence time in seconds for total flow rate of 2.0 L h^{-1}. The cyclone diameters are 500, 700 and 700 µm with 1500 µm height. The connecting channel dimension is 300 µm in 300 µm. (Reproduced from [Hofmann, G.H., Development of Methods and Devices for Spatially and Temporally Resolved X-Ray Microscopy for Characterization in Heterogeneous Catalysis, Dissertation, Karlsruhe Institute of Technology, Karlsruhe, Germany (2015), http://dx.doi.org/10.5445/IR/1000049565] with permission of G. Hofmann, Published under Creative Commons Attribution 3.0 DE License.)

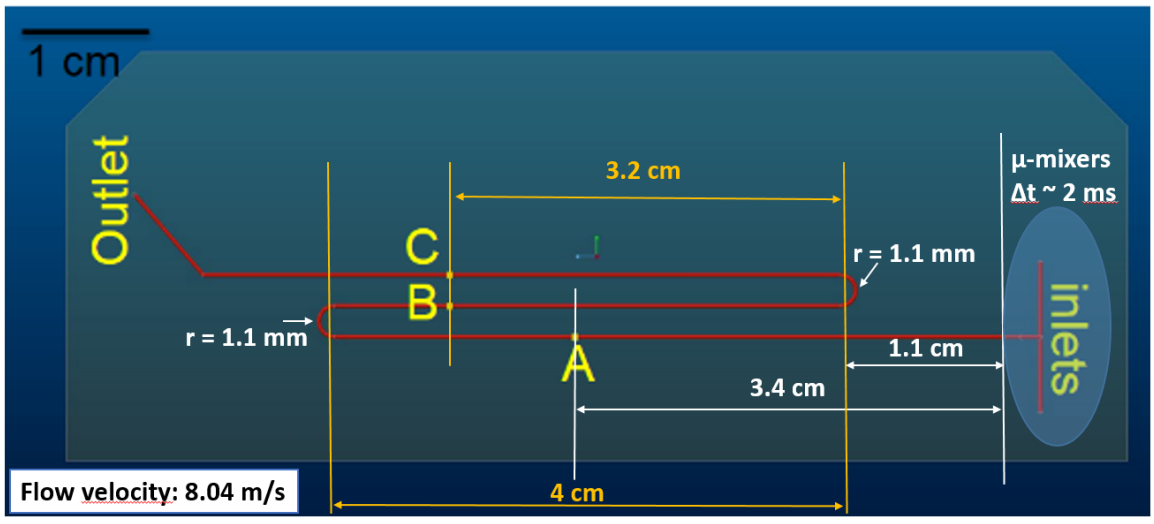

Fig. S3 Spatial-temporal points in the microchannel selected for XAS measurements (Positions A, B and C with corresponding reaction times of 6 ms, 10 ms and 18 ms.).

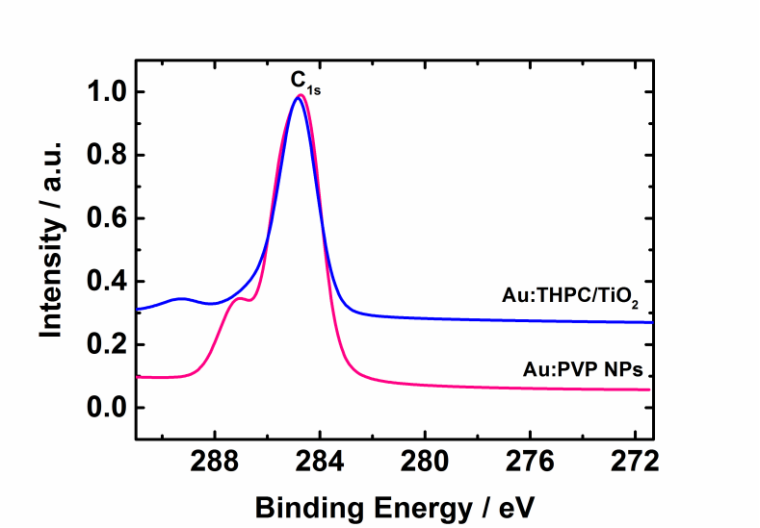

Fig. S4 XPS spectra of the C 1s level of Au:PVP NPs synthesized in microfluidic reactor and Au:THPC NPs synthesized in batch reactor and supported on titania.