Supplementary Information

for

Real-Time Optical Spectroscopy for *In-Situ* Single Droplet Analysis

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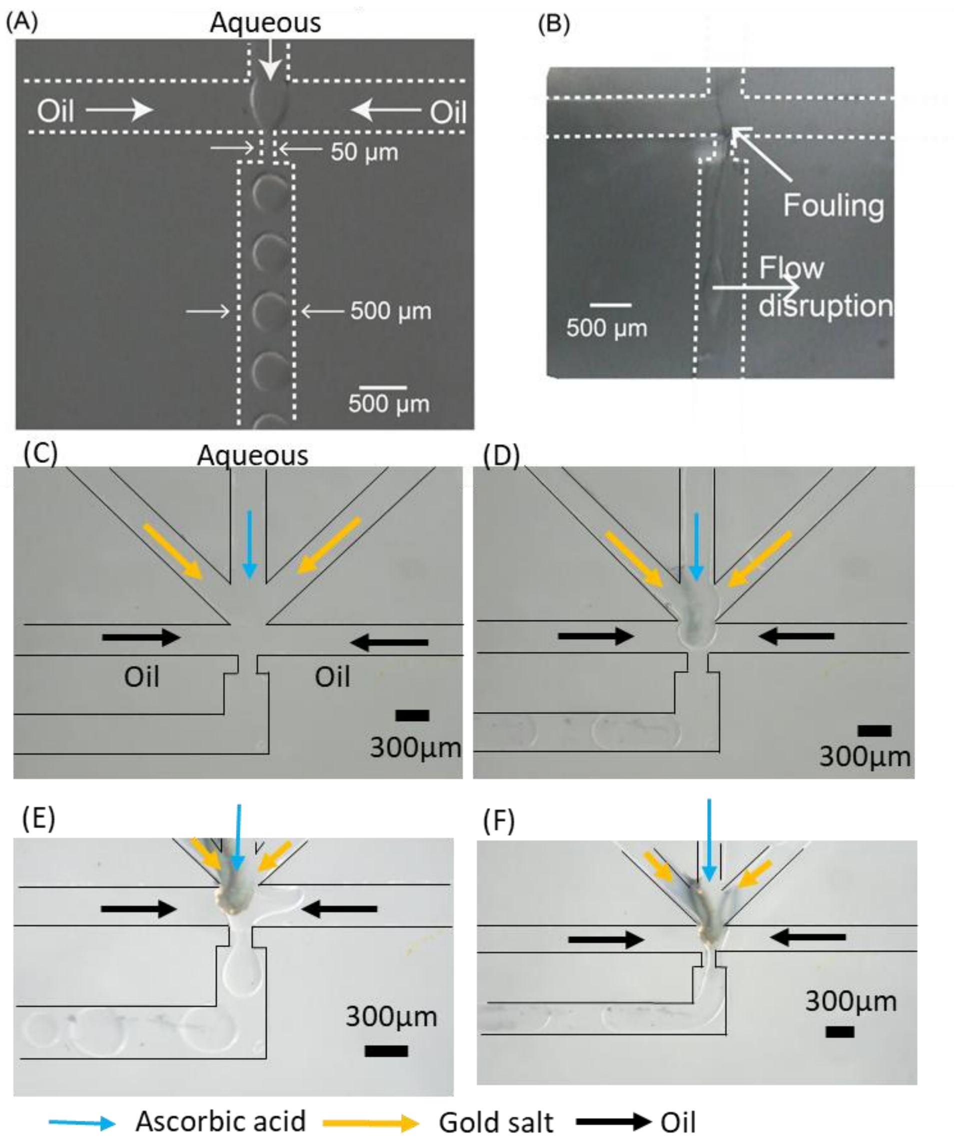

Figure S1: Drop generation and plasmonic nanomaterial synthesis in flow focussing device with 2 different dimensions of the narrow necking region **(A-B)** 50 µm width and 150 µm length and depth and **(C-F)** 200 µm width and 200 µm length and depth showing fouling at the necking zone and flow disruption. **A.** Spherical droplet generated in the flow-focusing device before reaction when the aqueous is only water; **B.** Formation of deposits at the necking zone and hence disruption of drop formation when water was replaced with reagents. **C.** Clean reactor before the reagents enter the channels. **D-F.** After the reagents flow in, channel deposition begins in 40 s leading to fouling near the junction and hence flow disruption. Channel deposits downstream of the necking zone is also visible in **E** and **F**.

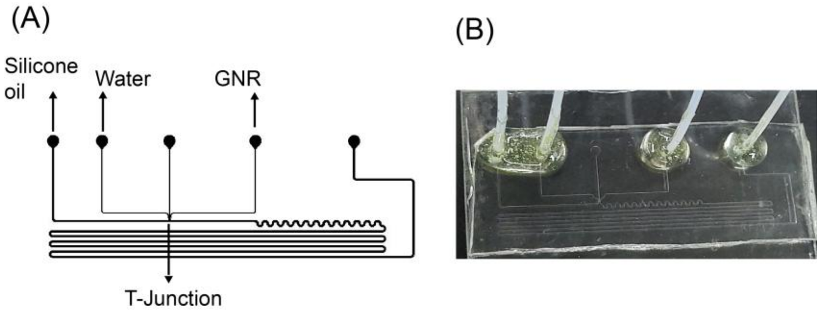

Figure S2: A. AutoCAD design drawing of the PDMS channel designs **B.** PDMS-based microfluidic device after incorporating the tubing and bonding of the chip to glass substrate.

Table S1: Flow rate details of Figure 3B

Q_a(μL/min)	Q_o(μL/min)	Q_t(μL/min)	$R = {Q_a}/{Q_o}$	V_a(cm/sec)	V_o(cm/sec)	V_t(cm/sec)
2	2	4	1	3.7×10^{-5}	7.4×10^{-5}	1.48×10^{-4}
4	2	6	2	2.6×10^{-5}	7.4×10^{-5}	2.22×10^{-4}
6	2	8	3	3.1×10^{-5}	7.4×10^{-5}	2.96×10^{-4}
8	2	10	4	3.46×10^{-5}	7.4×10^{-5}	3.70×10^{-4}
10	2	12	5	3.9×10^{-5}	7.4×10^{-5}	4.44×10^{-4}
12	2	14	6	3.64×10^{-5}	7.4×10^{-5}	5.18×10^{-4}

Q_a= Aqueous flow rate Q_o=Oil flow rate Q_t= Total flow rate of oil and aqueous V_a=Velocity of aqueous flow V_o=Velocity of oil flow V_t=Total velocity of oil and aqueous flow

$V_a = Q/A$, Where the area is calculated using droplet dimensions, for other velocities V_o, V_t The area is calculated using channel dimensions.

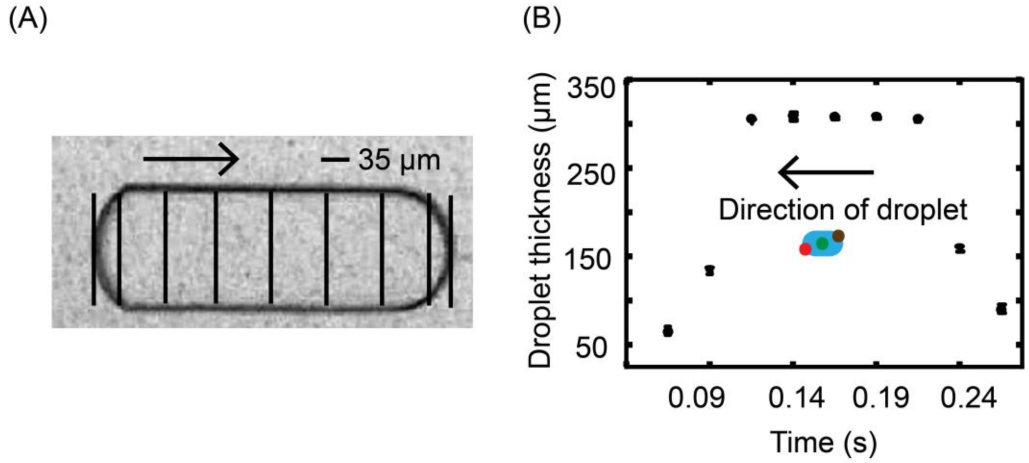

Figure S3: Droplet Variation Studies Using Stereo and Optical Microscopy A. The droplet image from the stereo microscope is partitioned and plotted. **B.** The droplet size was measured using stereo microscopic imaging across different time intervals and various sections of the droplet.

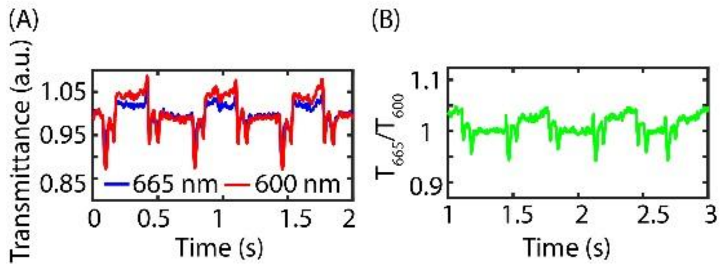

Figure S4: A. Normalized transmission as a function of time at two different wavelengths, i.e., at 665 nm (resonance wavelength of GNR) and 600 nm (off-resonance wavelength) for 3 sec. for water. **B.** The transmittance ratio between the two wavelengths noted in to identify the intensity variation in the oil phase and water loaded droplet region.

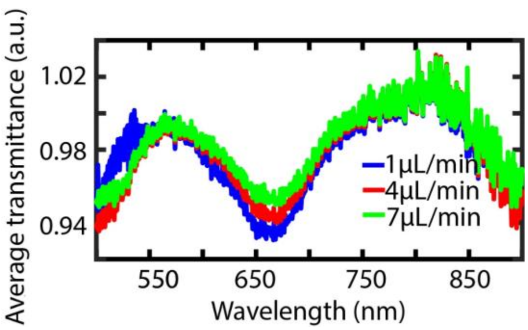

Figure S5: GNR average transmission spectra measured at three velocities for constant drop size for constant GNR concentration.

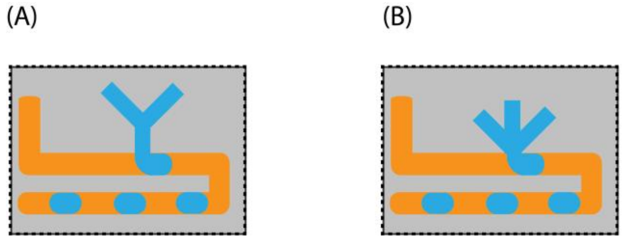

Figure S6: Variation of design near T-junction used for gold nanoparticle synthesis used **in A.** Case 1 – Influence of measurement location on the synthesis of gold nanoparticles (GNP) and **B.** Case 2 - Variation in the concentration of AA

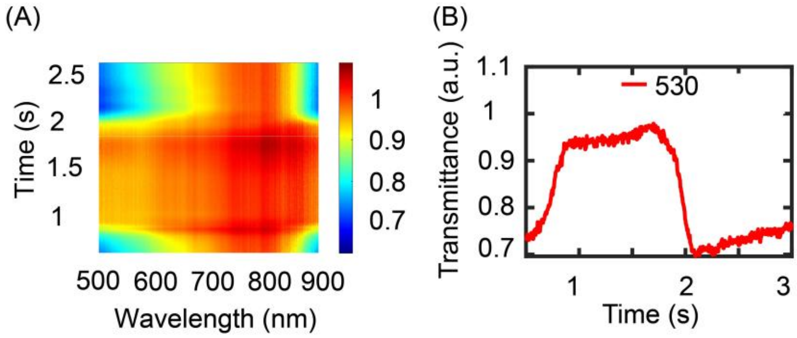

Figure S7: A. Spectral plot of GNR in the flow focusing device after fouling. **B**. Corresponding droplet analysis shows transmission vs Time