Electronic Supplementary Material (ESI) for Nanoscale.

Charge Effects and Nanoparticle Pattern Formation in Electrohydrodynamic NanoDrip Printing of Colloids

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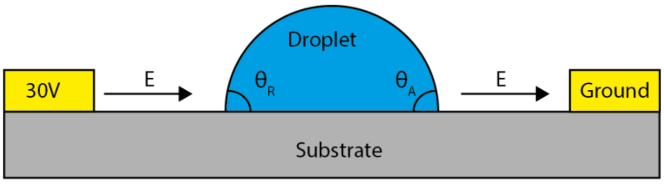
Deformation of the stationary droplet between the lateral electrodes

The following simple model assesses the deformation of a charged, hemispherical droplet in the electric field between the lateral electrodes used in the main text. :



Supplementary Figure 1: Sessile droplet between the lateral electrodes, with receding and advancing angle indicated.

Following Gent's model[1] of a volumetric force acting on a droplet we obtain:

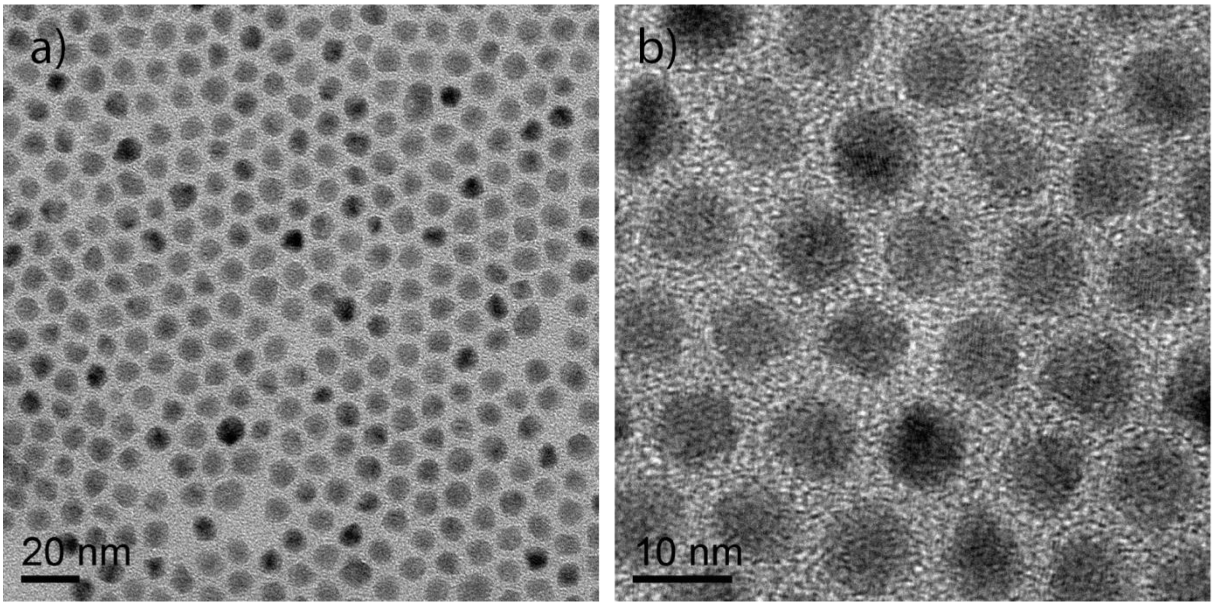
$$F_{el} = F_{hysteresis}$$

$$QE = \frac{4}{\pi} R\, \gamma_{C14} (\cos(\theta_R) - \cos(\theta_A))$$

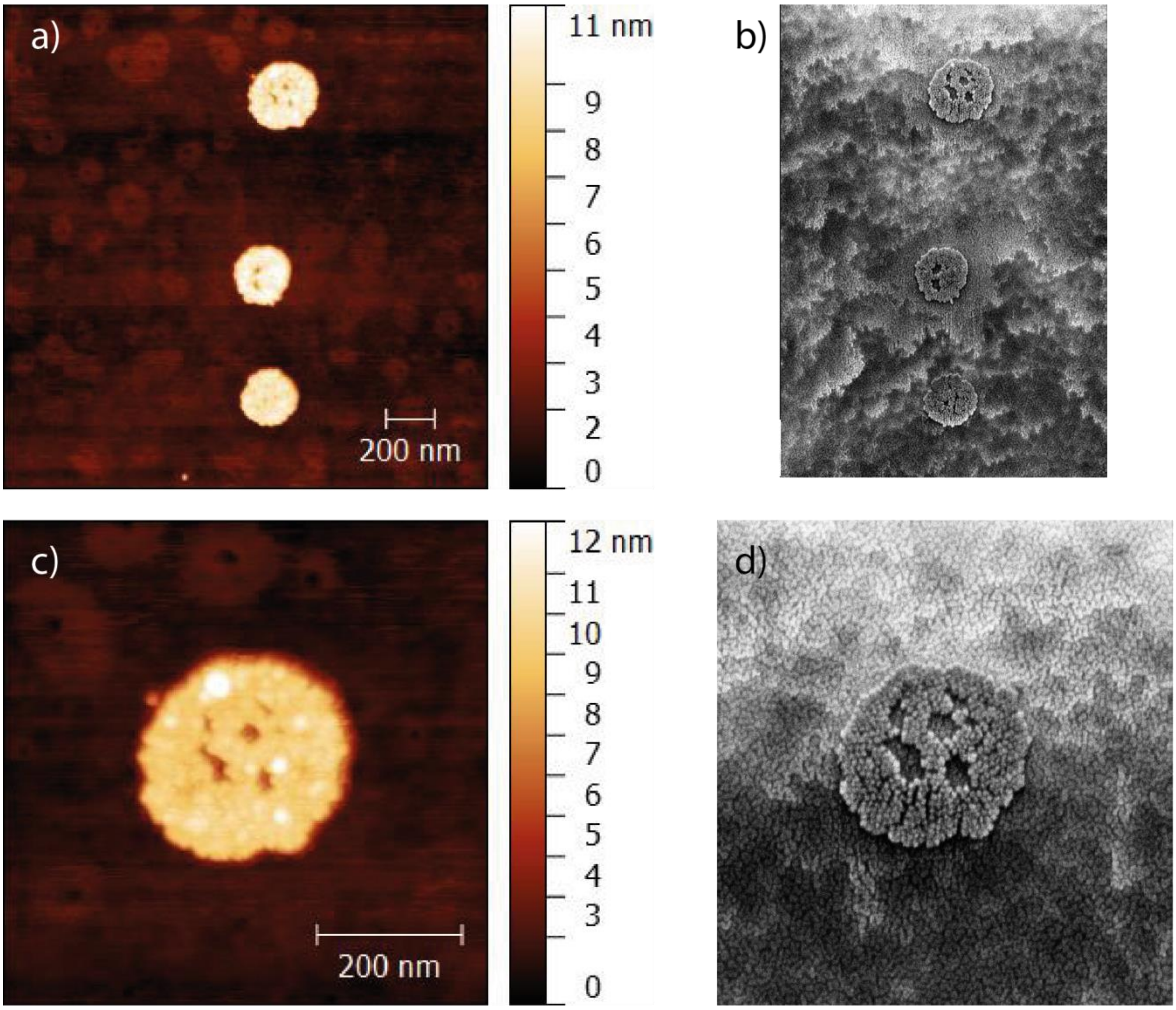
Where Q is the total charge in the droplet, E the electric field, R the droplet radius and γ_{C14} the surface tension of tetradecane. Further assuming a hemispherical droplet with a contact angle of 90° as a first approximation,[2] we take θ_R=90°+δ and θ_A=90°-δ for the receding and the advancing angle in the deformed droplet, respectively. For small δ the cosine function can be simplified and the equation can easily be solved for the deformation angle δ:

$$\delta = \frac{QE\pi}{2R\gamma_{C14}} = 1.8°$$

With Q=225q_0, E=1.5*10^7 V/m (homogenous field between electrodes at 30V, separated by 2µm), R=250nm (droplet contact radius, taken from Figure 3b in the main text), γ_{C14}=26.56mN/m[3]. This would lead to advancing and receding contact angles of 91.8° and 88.2°, respectively. This small deflection hardly justifies the massively asymmetric nanoparticle deposition we observe.



Supplementary Figure 2: TEM images of the quantum dots used for printing in the main text.



Supplementary Figure 3: AFM (a,c) and SEM (b,d) images of printed quantum dot footprints. The height of the footprints corresponds to one monolayer of quantum dots with a diameter of around 10 nm, as measured in the TEM scans. The AFM tip radius is nominally 8 nm, which means that the crevices between the single dots cannot be resolved. They can however very well be distinguished in the SEM graphs of the identical footprints on the right.

[1] C. W. Extrand, A. N. Gent, J Colloid Interf Sci 1990, 138, 431.
[2] N. J. Cira, A. Benusiglio, M. Prakash, Nature 2015, 519, 446.
[3] M. D. Lechner, C. Wohlfarth, B. Wohlfarth, *Surface tension of pure liquids and binary liquid mixtures*, Springer, Berlin etc. 1997.