Electrochemical Controlled Fluorophore Blinking for Enhanced Super-resolution Optical Fluctuation Imaging

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Super-resolution optical fluctuation imaging (SOFI) employs stochastic fluctuations of single emitters and disentangles the overlapping point spread functions by applying higher-order statistics.[1] With SOFI, greater molecule density and data with lower signal to noise can be tolerated compared with single molecule localisation microscopy, such as direct stochastic optical reconstruction microscope (dSTORM),[2] making SOFI a more robust and faster super-resolution imaging technique. SOFI imaging however is limited by the heterogeneity of fluorophore blinking across the sample which leads to vastly different SOFI pixel intensities such that features of lower intensity become difficult to visualize. Here, we introduced an electrochemical way to control the fluorophore blinking for SOFI. Utilizing an oscillating electrochemical potential, both the uniformity and kinetics of the fluorophore blinking are enhanced that results in improved imaging resolution. We demonstrated that the electrochemical SOFI imaging modality can produce comparable image resolution to dSTORM but with 8 times less acquisition time.

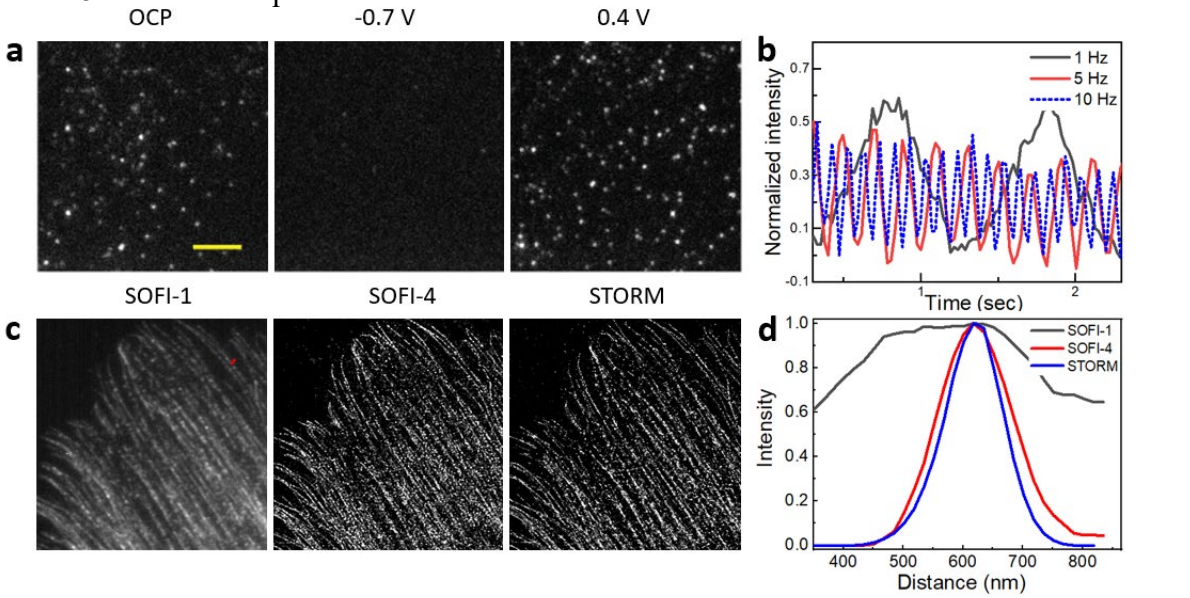

Figure 1: **a**, Electrochemical control of the on-state Alexa 647 density under open-circuit potential, -0.7 V 0.4 V. **b**, The mean frame fluorescent intensity shows the corresponding changes with oscillating electrochemical potentials between -0.7 V and 0.4 V with frequency of 1, 5, and 10 Hz. **c**, From left to right, 1st, 4th order SOFI, and dSTORM of the cell microtubules from the same cell. **d**, Comparison of resolution between SOFI and STORM images, the intensity profiles were extracted from the red line in c as shown. Scale bar = 2 μm.

References

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