

OPTICALLY CONTROLLING ERYTHROCYTES IN A SCANNING TOTAL INTERNAL REFLECTION MICROSCOPE

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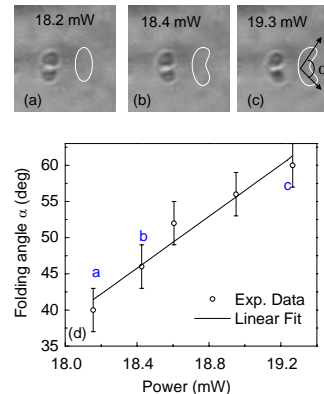
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1. INTRODUCTION

It has been demonstrated both experimentally and theoretically that the focal spot distributions produced by an ultra high numerical aperture (NA=1.65) objective lens under the total internal condition behaves evanescent [1, 2]. Due to the highly confined nature, the strength of the evanescent focal spot is so strong that nonlinear near-field excitation becomes possible. The utilisation of superresolution optics, the transverse size of the focused evanescent spot can be as small as 100 nm, which could be useful for single molecule detection. One of the most important applications of focused evanescent illumination is laser trapping and manipulation [3]. In this case, the axial trapping volume is only a few tens of nanometres. Such a nanometric laser trapping technique provides a new tool for cell manipulation. In this talk, we will present our recent progress on near-field laser trapping of erythrocytes [4]. It has been shown that biconcave-shaped red blood cells can be trapped, rotated and folded by a focused evanescent spot.

2. NEAR-FIELD LASER TWEEZING OF ERYTHROCYTES

The figure in the left shows the optical folding of a trapped red blood cell (RBC) in near-field laser tweezers. Successive frames (a) – (c) are taken from the video showing the folding of an RBC trapped in the horizontal plane. The dependence of the folding angle of an RBC trapped in the horizontal plane as a function of the trapping power is given in (d), where the conditions corresponding to (a) – (c) are marked. The linear dependence of folding on the trapping power in a single beam near-field laser trap provides a new tool to investigate, quantitatively and simultaneously, the cell mechanical properties.



References

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