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Nano-structuring for Molecular Motor Control

Mercy Lard, L. ten Siethoff, S. Kumar, M. Persson, G. te Kronnie, A. Månsson, and H. Linke

Abstract The interaction of self-propelled biological molecular-motors and cytoskeletal filaments holds relevance for a variety of applications such as biosensing, drug screening, diagnostics and biocomputation. The use of these systems for lab-on-a-chip biotechnology applications shows potential for replacement of microfluidic flow by active, molecular-motor driven transport of filaments. The ability to control, confine and detect motile objects in such a system is possible by development of nanostructured surfaces for on-chip applications and fundamental studies of molecular-motors. Here we describe the localized detection (Lard et al., Sci Rep 3:1092, 2013) and fast transport of actin filaments by myosin molecular-motors (Lard et al., Biosens Biolectron 48(0):145–152, 2013), inserted within nanostructures, as a method for biocomputation and molecular concentration. These results include extensive myosin driven concentration of actin filaments on a miniaturized detector, of relevance for use of molecular-motors in a diagnostics platform. Also, we discuss the local enhancement of the fluorescence signal of filaments, relevant for use in a biocomputation device where tracking of potentially thousands of motile objects is of primary significance.

M. Lard (✉) • H. Linke
The Nanometer Structure Consortium (nmC@LU), Division of Solid State Physics, Lund University, SE-221 00 Lund, Sweden
e-mail: mercy.lard@ftf.lth.se

L. ten Siethoff • M. Persson • A. Månsson
Department of Chemistry and Biomedical Sciences, Linnaeus University, SE-391 82 Kalmar, Sweden

S. Kumar
Department of Chemistry and Biomedical Sciences, Linnaeus University, SE-391 82 Kalmar, Sweden

Department of Biotechnology, Delhi Technological University, Delhi-110042, India

G. te Kronnie
Department of Women's and Children's Health, University of Padova, 35131 Padova, Italy

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