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Nanofluidic redox-cycling in electrochemical biosensing applications BERNHARD WOLFRUM, MARCEL ZEVENBERGEN, SERGE LEMAY, Kavli Institute of Nanoscience, Delft University of Technology — We have developed a chip-based nanofluidic device which amplifies the sensitivity in electrochemical biosensing applications by orders of magnitude. The amplification is based on rapid redox-cycling between plane parallel electrodes inside a nanochannel. We show that it is possible to monitor the signal of less than a hundred molecules residing in the active area of the nanofluidic sensor. The small number of molecules is reflected in the noise spectrum of the device. In particular, we obtain high sensitivities when detecting catecholamines, which comprise an important group of hormones and neurotransmitters such as serotonin and dopamine. Furthermore, due to the nanochannel design, the sensor is immune to interference by molecules undergoing irreversible redox reactions. We demonstrate the selectivity of the device by detecting target molecules in the presence of ascorbic acid whose oxidized form is only stable on the order of milliseconds. The interference of ascorbic acid is usually a challenge in the detection of catecholamines in biological samples.

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