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Nano-Channel Impedance Arrays for Biomolecular Detection HSUEH-CHIA CHANG, GILAD YOSSIFON, University of Notre Dame — We have designed and tested nanochannel impedance sensors for biomolecular detection based on fundamental analyses of the underlying electrokinetic phenomena. Probe-functionalized nanocolloids (macroions) with specific hybridized and unhybridized impedance signals are used to capture multiple molecular targets. These nanocolloids are driven electrophoretically, electro-osmotically or dielectrophoretically by a slow (and high-amplitude) AC field into the nanochannels, where field focusing amplifies their impedance signal. Detection is carried out at a higher frequency close to the inverse RC time of the channel. We find, however, that the impedance of a multi-channel array is not a superposition of the single nanochannels, once the depletion/enrichment zones at the two ends of the nanochannels overlap. Hence, detection sensitivity can be greatly enhanced if the nonlinear and non-equilibrium ion and macro-ion accumulation dynamics in the nanochannel is understood.

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