Challenges and trends in the development of a magnetoresistive biochip portable platform

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Abstract: The magnetoresistive (MR) biochip concept has emerged a decade ago and since then considerable achievements were made in the field. At the moment there is a strong effort in building up a fully integrated, portable and accessible spintronic device for bioanalytical assays. Some of the major challenges and working solutions are addressed here. In a MR-biochip platform five main components can be identified as key points for its success: the MR sensing elements, the magnetic labels, the surface chemistry, the microfluidic system and the read-out electronic set-up. Linear spin valve sensors were fabricated with good sensitivity and proper field range. Magnetic particles were carefully characterized and selected seeking for the best biomolecular labels. The surface chemistry was extensively optimized in order to get it more efficient, specific and reproducible. A microfluidic structure was designed and fabricated in polydimethilsiloxane (PDMS) to work as sample transportation and simultaneously control the wash out steps. Finally, a portable and autonomous electronic microsystem provides the electronic circuitry to control, address and read-out up to 256 sensors. From the assembling of all these components emerges a versatile portable platform. The first results from the platform in a real-time detection of 20mer single stranded DNA sequences labeled with 130 nm magnetic labels are presented.
Author Keywords: Biomolecular recognition; Magnetic label; Magnetic tunnel junction; Magnetoresistive biochip; Microfluidics; Portable platform; Spin valve

Year: 2010
Source title: Journal of Magnetism and Magnetic Materials
Volume: 322
Issue: 12-Sep
Page : 1655-1663
Cited by: 4
Link: Scorpus Link
Document Type: Article
Source: Scopus

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