Injection-moulded micro-cantilever arrays for detecting DNA sequences

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INTRODUCTION: Cantilever sensors detect surface stress created by the interaction of analytes with functional sensor surfaces. Variotherm injection molding technique was employed to fabricate 22 µm-thick polypropylene micro-cantilever arrays. These micro-cantilevers (MC) were functionalised and tested for detecting single-stranded DNA sequences.

METHODS: Variotherm injection molding using metal molds made by laser ablation was applied to fabricate disposable polymeric MC-arrays (see Fig. 1). The cantilevers were coated on one side with 4 nm chromium and 20 nm gold. The array of eight MCs each 500 µm long, 100 µm wide and 22 µm thick was functionalised by means of the Cantisens® FU-401 functionalization unit. The MCs 1, 2, 5, 6 were functionalised with a ss DNA oligonucleotide "Nl4-3" sequence, and MCs 3, 4, 7, 8 with "Sf162". All measurements were done using the Cantisens® Research platform. The experiments were conducted at a temperature of 30 °C, with a constant flow (0.42 µl/s) of a 1M NaCl buffer solution. The sample solution used in this experiment was 1 µM complementary Sf162 diluted in the 1M NaCl.

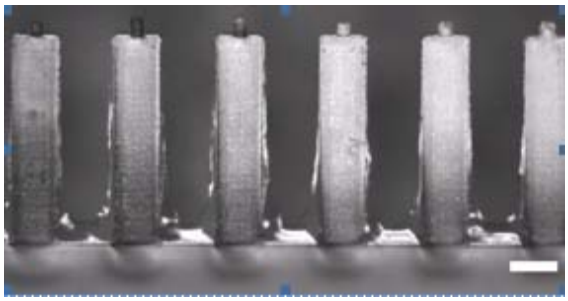

Fig. 1: Optical micrograph of a variotherm injection-moulded polypropylene micro-cantilever array. The scale bar is 100 µm.

RESULTS: The difference of the deflection signals from the reference MCs (1, 2, 5, 6) and the signal MCs (3, 4, 7, 8) is shown in Fig 2. The first sample injection of the complementary Sf162 sequence gives a 7 nm signal, which is comparable to the signals achieved with Si cantilevers.[1] A second injection of the same complementary sequence was a control for saturation from the first injection and led to a 1.5 nm differential signal.

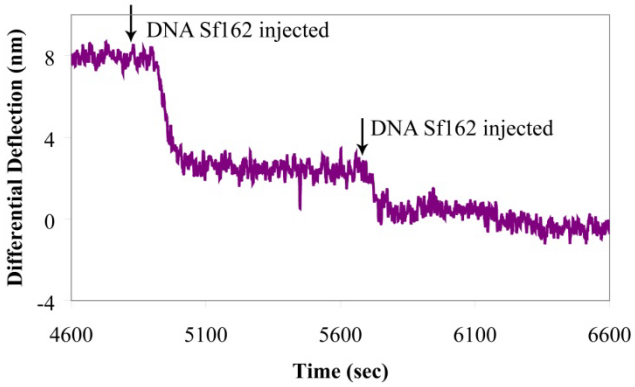

Fig. 2: Deflection upon hybridisation of the complementary sequence.

DISCUSSION & CONCLUSIONS: Polymer micro-cantilever arrays can be used to detect specific DNA sequences. These MCs can be surface structured using the hybrid technology described previously,[2] which can enhance the amplitude of the deflection signal. Surface structuring also enhances cell adhesion and cell spreading, which is vital for further applications including measurement of contractile cell forces,[3] thus opening a wide variety of single-use applications in the field of biomedicine.

REFERENCES: [1]J. Köser, P. Shahgaldian, M. Bammerlin, F. Battiston, U. Pieles (2007) *J. Phys.* **61:**612-617. [2]P. Urwyler, H. Schift, J. Gobrecht, O. Häfeli, M. Altana, F. Battiston, B. Müller (2011) *Sensors and Actuators A* in press. [3]J. Köser, J. Gobrecht, U. Pieles, B. Müller (2008) *Eur. Cells Mater.* **16**:38.

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