

## TUNABLE PDMS NANOSTRUCTURED SURFACES THROUGH REPLICATION OF NANOSCALE TOPOGRAPHY OF DIBLOCK COPOLYMER MICELLAR THIN FILMS

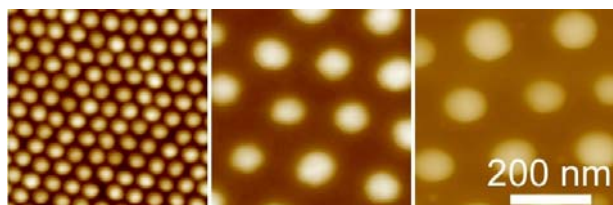
[S. Krishnamoorthy](#)<sup>1</sup>, [R. Pugin](#)<sup>1</sup>, [M. Liley](#)<sup>1</sup>, [M. J. Dalby](#)<sup>2</sup>, [R.O.C. Oreffo](#)<sup>3</sup>, [H. Heinzelmann](#)<sup>1</sup>,  
[J. Brugger](#)<sup>4</sup>, [C. Hinderling](#)<sup>1</sup>

<sup>1</sup> *Centre Suisse d'Electronique et de Microtechnique SA (CSEM SA), Neuchatel, Switzerland*

<sup>2</sup> *Centre for cell engineering, University of Glasgow, Glasgow, UK* <sup>3</sup> *University Orthopaedics, Southampton General Hospital, UK* <sup>4</sup> *Microsystems Laboratory (LMIS1), Ecole Polytechnique Federale de Lausanne (EPFL), 1015, Lausanne, Switzerland*

**INTRODUCTION:** This report will focus on creation of nanostructured PDMS surfaces with tunable feature dimensions and periodicities, and the use of these surfaces to study the influence of nanotopography on cell-substrate interactions. The topography on surfaces is known to influence cell-adhesion and growth behaviour.<sup>[1]</sup> PDMS is attractive as cell-culture substrate owing to its biocompatibility, ease of structuring, flexibility, tunable hardness and transparency. PDMS is recognized as a promising material for making bioactive bandages that assist in wound healing.

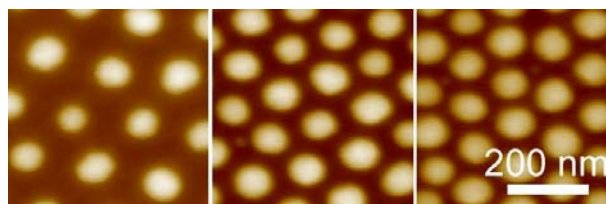
**METHODS:** The nanostructured PDMS surfaces are fabricated by replication of topography offered by poly(styrene-*b*-2-vinylpyridine), (PS-*b*-P2VP) micellar thin films on silicon surface. A monolayer of spherical micelles is deposited from *o*-xylene solution by spin-coating to obtain a quasi-hexagonally ordered array on silicon surface. The tunability of the dimensions of the micelles is achieved by changing the solvent quality, humidity of the environment during film formation, coating conditions and by changing polymer molecular weights. PDMS pre-polymer (SYLGARD 184) is mixed with the curing agent in 10:1 ratio and poured on the micelle coated substrate, cured at 65°C for 3 hours and peeled off. The substrates are then characterized with tapping mode AFM for the topography.



*Fig. 1 Tuning micelle dimensions with molecular weight. Molecular weight of the copolymer increases from left to right*

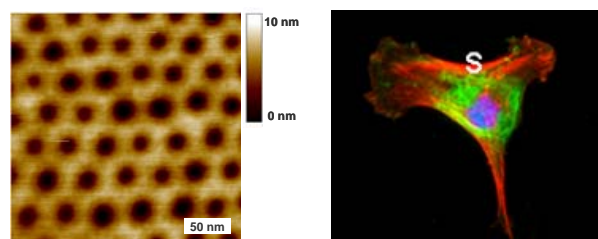
**RESULTS:** The tunability of PS-*b*-P2VP spherical micelles was achieved in the 30-110 nm range and the periodicity was tuned in the 30-150 nm regimes. Replication of the micellar thin film topography was realized in PDMS forming an

array of pits on PDMS surface. The dimension, spacing and depth of the pits were varied by replicating from the appropriate micellar array. Replication of 18nm high micellar topography formed pits that were 7 nm deep in PDMS. Work is in underway to analyse the differences in cell response to the nanostructures.



*Fig. 2 Tuning micelle periodicity with coating conditions. Left to right the periodicity decreases*

**DISCUSSION & CONCLUSIONS:** We present a continuous tunability of micellar film topography and easy replication of their periodic topography in PDMS. We find a good fidelity of replication in the plane, but poor depth fidelity, apparently due to the surface tension of PDMS. First results with cell culture on nanoscale topographically patterned PDMS substrates are presented.



*Fig. 3 (left) holes in PDMS obtained by replication of the micellar film topography and (right) an immunofluorescence image of a primary human mesenchymal stem cell grown on a structured PDMS substrate.*

**REFERENCES:** <sup>1</sup> C. D. W. Wilkinson, M. Riehle, M. Wood, J. Gallagher and A. S. G. Curtis, *Mat. Sci. & Eng. C.* **2002**, 19(1-2), 263

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