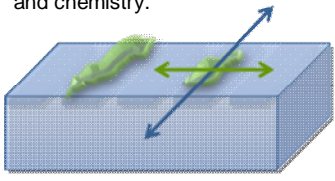


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Introduction

Understanding cell adhesion and migration behaviour on surfaces is indispensable for successful design of novel biomaterials. Therefore we strive to independently control the main influential factors, topography, chemistry and elasticity [1], with samples made with our newly developed **FIMIC** (Fill-Molding In Capillaries) method [2]. Furthermore Combining soft-lithographical micro-patterning [3] with hydroxyapatite nano-particles (HA NPs) [4] yields surfaces with cell adhesive and cell repellent properties as well local control of stiffness and chemistry.



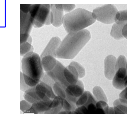
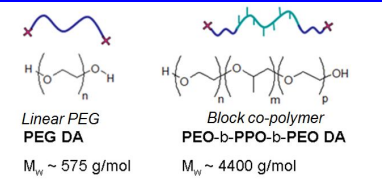
Goal Substrate: Patterns of Elasticity

- Local variation of stiffness
- Topographically smooth
- Locally (bio)functionalisable

Chemistry

	material	Properties
Elastomers	Linear Poly-ethylene-glycol (PEG)	- hydrophilic - non-fouling - non-cytotoxic* - stiffer (E ~ 100 MPa)
	Block co-polymer [BC]	- hydrophobic - non-cytotoxic* - softer (E ~ 3 MPa)
mineral	Hydroxy-apatite (HA)	- tailormade** - bioactive*** - rode-like NPs

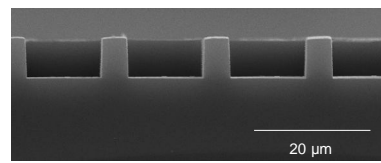
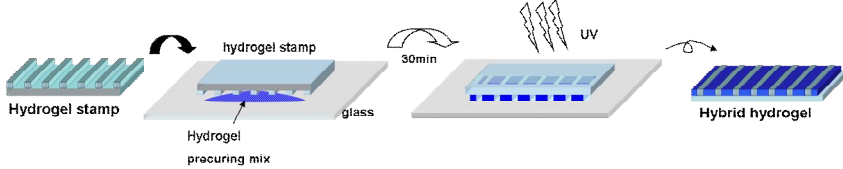
* - Colony formation assay (CFA) ** - precipitation method
*** - high CO₂ content
- Ca-deficient (Ca/P 1.62)
(Calcium nitrate tetra hydrate and diammonium hydrogen phosphate as starting material)



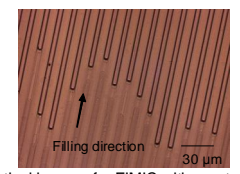
$Ca_{10-x}(PO_4)_6-x(HPO_4)_x(OH)_{2-x}$ with $0 < x < 2$
Chemical formula and TEM image of HA NPs.

Soft-lithographical method

Illustration of our newly developed **FIMIC** (Fill-Molding In Capillaries) method



SEM image of cross-section of a FIMIC.

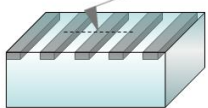


Optical image of a FIMIC with empty and filled grooves.

Results

AFM Characterisation of FIMICs

Topographical imaging

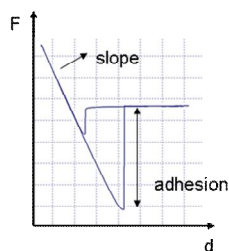


Topography very smooth in air and water:

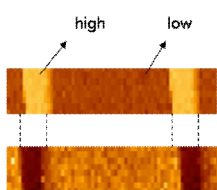
The slight depression below represents ca. 1% (0.04 – 0.3 μm over a span of 50 μm). This is probably caused by shrinking of the gel during curing.



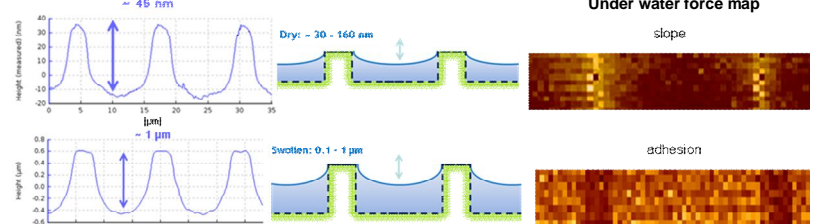
Force - mapping



Elasticity

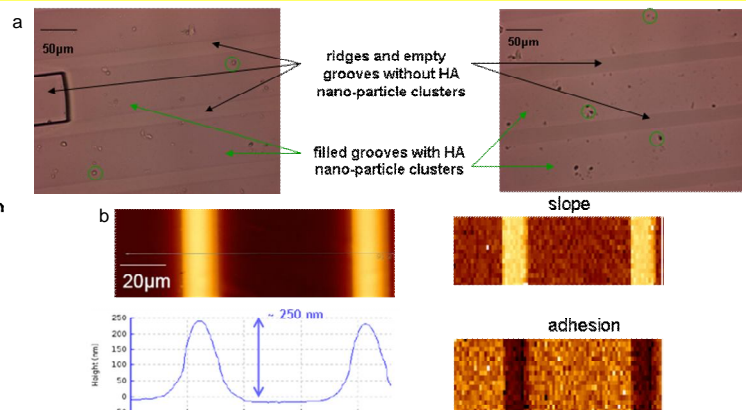


AFM analysis in dry and swollen state of FIMICs using stiff PEG and soft BC



A significant increase can be observed due to differential swelling in water

FIMIC patterning with HA-nano-particles



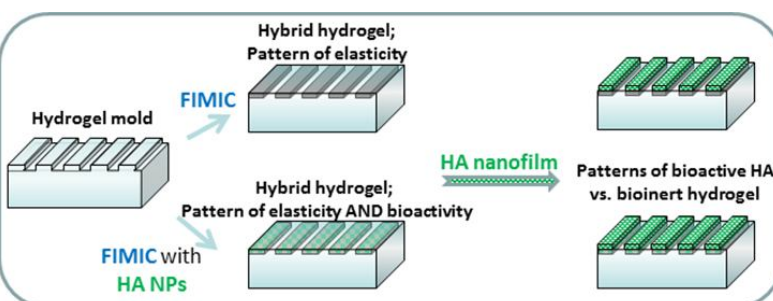
Results from (a) optical microscopy and (b) AFM demonstrate FIMICs introducing HA NPs.

Summary and outlook

Successful fabrication of nearly smooth surfaces including hydroxyapatite by the newly developed FIMIC method

Equalizing surface topography of FIMICs in swollen state

Local surface functionalization with a bioactive hydroxyapatite layer [5].



Literature

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[4]. Neffe A.T. et al. *Acta Biomater* (2011), 7, 1693-1701
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