Karlsruhe Institute of Technology

Institute of Functional Interfaces (IFG)
Stem Cell-Material Interactions

Nanostructured multifunctional polymer films as hematopoietic stem cell culture substrates

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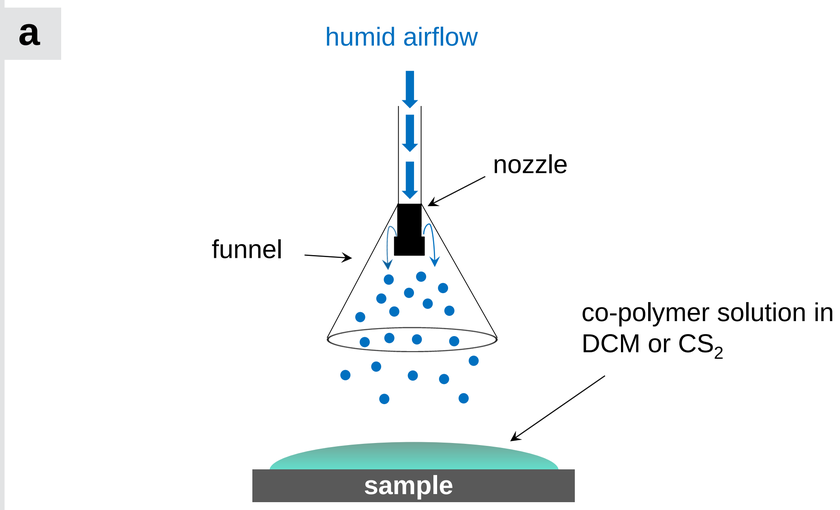
1 Background and Aim

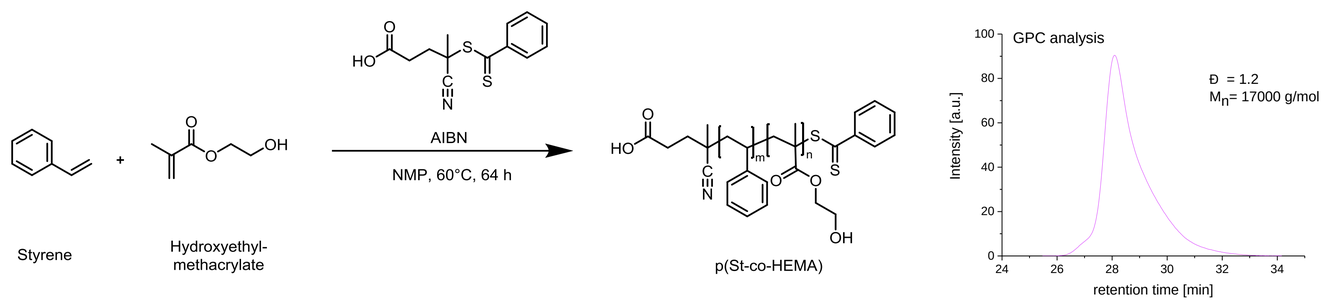
- Hematopoietic stem cells (HSCs) are used for treatment of malignant diseases of the blood (*e.g.* leukemia) but donors are rare.[1]
- The *in vitro* culturing of undifferentiated HSCs is strongly limited by currently available cell culture techniques.[2,3]
- The development of fully synthetic cell culture systems, mimicking the HSC niche in the bone marrow, could allow the expansion of HSCs' in clinical applications.
- *In vitro* studies show that the arrangement of ligands on the nanometer scale influences the behavior of HSCs.[4,5]
- Multifunctional honeycomb-patterned porous films prepared *via* the breath figure approach[6,7] as potential cell culture systems, might help to understand and control HSCs' growth.

2 Breath Figure Approach

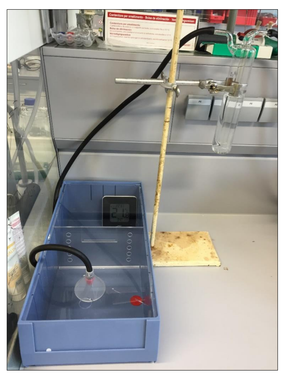


3 First Results

- Synthesis of random p(St-co-HEMA) *via* RAFT polymerization (test system)



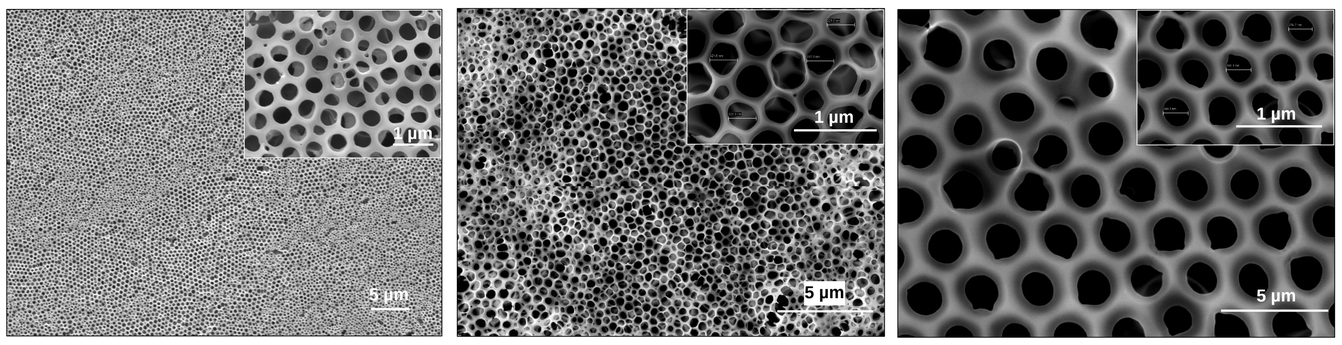
- Casting process using a custom designed box at constant humidity



film morphology is affected by

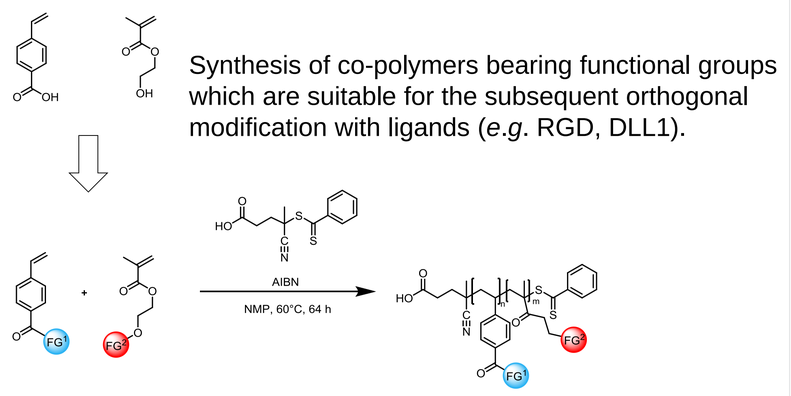
- air flow rate
- relative humidity
- solvent properties
- solution concentration
- type of polymer and polymer architecture

- Selection of SEM images: 40% relative humidity, 10 mg/mL polymer in DCM



influence of the air flow rate: decreasing from left to right

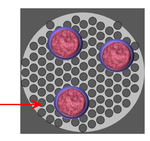
4 Outlook



Synthesis of co-polymers bearing functional groups which are suitable for the subsequent orthogonal modification with ligands (*e.g.* RGD, DLL1).

Multifunctional co-polymers will be used for the fabrication of honeycomb-structured surfaces aiming for ligand distances in the nanometer scale. In the future, this polymer films will be compared to natural ECM derived surface coatings with regards to their effects on the proliferation of undifferentiated HSCs in order to establish the applicability of this approach.

HSCs growing on multi-functional honeycomb structures



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[2] A. Dahlberg *et al*., *Blood* **2011**, *17*, 6083-6090.
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