Chemical surface modifications: avoid unspecific binding of biomolecules

Unspecific binding:

Due to the large surface to volume ratio in micro cavities, the effect of unwanted unspecific binding of biomaterials to the walls is enhanced. This type of non-covalent adsorption could be more or less irreversible depending upon the materials, liquid properties and biomolecules involved as well as the conditions for and duration of exposure. These phenomena may cause serious problem in various lab-on-a-chip analytical systems (Fig. 1) such as immunoassays, PCR and others particularly when solutions having low concentrations of the biomolcecules are involved. The microBUILDER chemical modification services include various protocols for chemical treatment of these surfaces in order to minimize unspecific binding.

The chemical treatments available in order to minimize unspecific binding:

- Processes for chemical coupling of silane-polyethylene glycol (PEG) (1) to create brush-like hydrophilic layers covering the polymeric materials (COC) and SiO2 (Fig. 2).
- Coating instructions to create (mono)layers of inert (blocking) proteins (Bovine Serum Albumin (BSA) or Casein) on surfaces either obtained by pre-coating or in a dynamic process where the blocking protein is included in in reagents solutions involved (2).

Poly(ethylene glycol) (PEG) films are very well suited in the field of biomedical engineering due to their ability to control biomolecular interactions with device surfaces (3). They have been used to prevent biofouling in bio-microsystems, tissue engineering applications, drug delivery, and cell patterning (4-7). Protein coating is widely used in lab-on-a-chip devices(8).

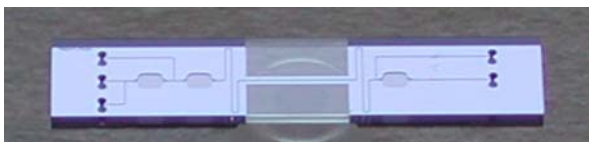

Figure 1.
Lab-on-a-chip device (SINTEF)

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Application fields:

- Bio-analytics, drug development systems and *in vitro* diagnostics (Lab On A Chip (immunoassays, PCR, NASBA,…)
- *Ex vivo* and *in vivo* diagnostics (micro-channels, sensors and actuators)
- Medical devices for *in vivo, ex vivo* or in vitro use such as:
  - Drug delivery systems
  - Physiological monitoring equipments
  - Implant
  - Artificial organs
  - Sensors and actuators
  - Micro-reactors

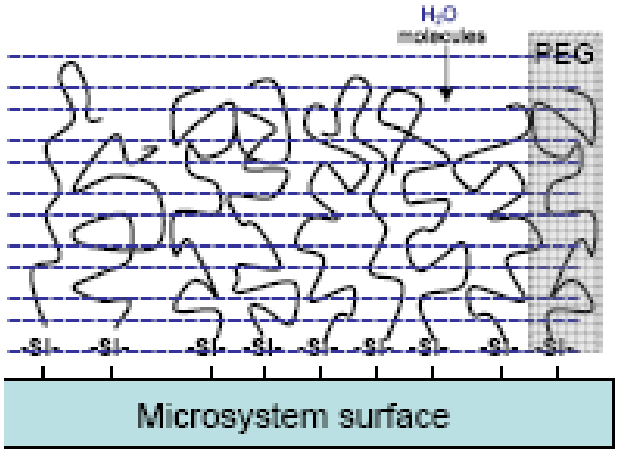

Figure 2.
Illustration of the hydratisation of the brush-like structure of PEG as coupled to surfaces like Silicon (SiO_2), glass and plasma treated polymers (COC) by silanisation.

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Contributing partner

SINTEF

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