DELIVERABLE

D1.1

Developed strategies for switchable adhesion based on responsive polymer thin films

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The ultimate goal of this deliverable was to develop strategies for switchable adhesion properties underwater based on responsive polymeric thin films. For this, we systematically investigated an effect of architecture of layer of brush-like layer of polymer chains consisting of stimuli-responsive and adhesive parts on switching of adsorption/adhesion behaviour.

First, we synthesised block-copolymer and statistical random copolymer brushes formed by thermoresponsive poly-(N-isopropylacrylamide) with inclusions of adhesive/charged fragments of poly-(2-dimethylaminoethyl methacrylate). According to our idea poly-(N-isopropylacrylamide) provides switching of conformation of polymer chains, while poly-(2-dimethylaminoethyl methacrylate) plays a role of functional group, which provides adhesion. Poly-(2-dimethylaminoethyl methacrylate) was selected because electrostatic interactions are one of the strongest non-covalent interactions, which can provide a combination of both strength and reversibility of binding.

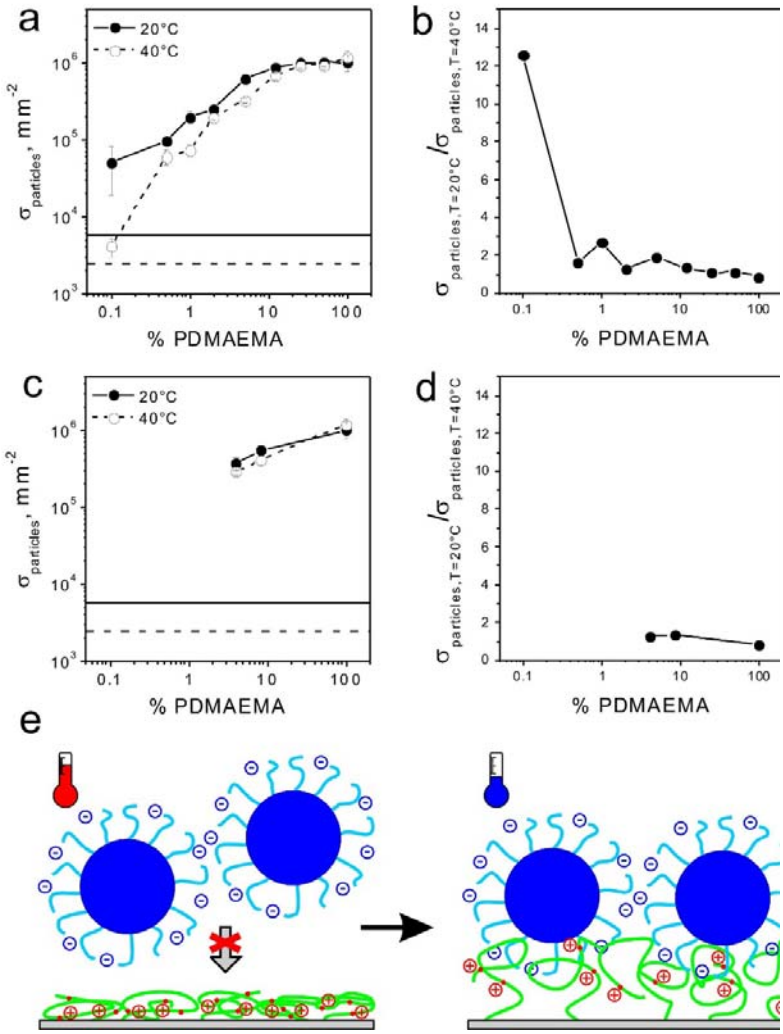

Figure 1. Numerical results of adsorption of PAA-modified particles adsorbed on PDMAEMA -PNIPAM block copolymer and random copolymer brushes at 20°C and 40°C.

The switching properties were investigated by adsorption/adhesion of colloidal particles charged oppositely to the change of functional groups in the brush. We found that strongest adsorption/adhesion is achieved at high fraction of charged/adhesive groups. Contrary to this, the most pronounced switching of adsorption/adhesion is achieved at lowest fraction of charged/adhesive groups. The fraction of the lowest fraction of charged/adhesive groups is that low (1 group per few polymer chains) that can be achieved by designing of statistical random copolymers and not by block copolymers. [the manuscript is under preparation and will be submitted soon] (Figure 1).