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## QCM-D as clinical diagnostics tool

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Apart from the QCM-D's (Quartz Crystal Microbalance with Dissipation) outstanding potential for thrombosis and haemostasis in therapeutic directions and decisions, it is attractive as diagnostic tool for clinical challenges in the prospective of cost-effectiveness, robustness and straight forwardness. An important relevant example is Heparin induced thrombocytopenia (HIT) platelet aggregation diagnostics. For HIT today's clinics rely on functional assays including HIPA tests (heparin induced platelet aggregation) and serotonin release tests. HIT assays are part of clinical diagnostics but these need high expertise in this area. Owing to tediousness, time consumption and costs such tests should not be performed in laboratories with limited experiences in this area. QCM-D has outstanding potential for HIT detection of destructive antibodies via using ultrasensitive thin films.

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## Switching behavior of biomolecules attached to a responsive polymer brush

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Many investigations over the years have shown that the interaction of surface grafted polymer brushes with biomolecules, e.g. proteins, receptors, has a great importance for a significant number of applications. Here we present on the design of a smart polymer brush/biomolecule architectures, produced via the "grafting to" approach. For this, individual protein molecules, labelled with the fluorophore ATTO488, were covalently attached to a single, pH responsive poly(acrylic acid) (PAA) brush. Subsequently, total internal fluorescence microscopy (TIRF) was used to monitor intensity changes over time, when switching between low and high pH. We show that the fluorescence intensity of a single protein molecule shows an on-off switching behavior, controlled by the solution pH. Fluorescence intensity is quenched (off state) by 85% when the PAA chains are stretched at basic pH, yet we observe an enhancement in the fluorescence (on state) when the polymer chains collapse at basic pH. Furthermore, we use the local density of optical states (LDOS) effect to predict the location of a molecule that is covalently (or electrostatically) attached to a polymer brush. Fluorescence lifetime was 3.5 ns when the polymer was stretched away from the grafting interface at basic pH, whereas the lifetime is quenched to just 2 ns at acidic pH. Moreover, we support our experimental results with numerical self-consistent field (nSCF) theory. Biomolecules can be either in (on state) or outside (off state) of the brush and by fine-tuning the brush parameters and particle size it becomes possible to use this system as a biosensor.

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