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"Functional Paper Through Tailored Polymer Attachment: from paper based microfluidics to paper based sensors"

Throughout the last decade, we have witnessed an increasing amount of studies, addressing the use of the *low-cost* material paper in *high-tech* applications, progressing from substrates for blood-typing, to enzymatic reaction engineering, low-cost DNA-sensors and purification of antibodies. Paper is a particularly attractive substrate for such applications due to interesting advantageous properties: (i) no external pumps are needed for the fluid transport due to capillary forces, (ii) paper can be considered as low-cost material consisting of the earths most abundant material: cellulose, and (iii) the lignocellulosic fiber surface can be chemically modified by various chemical means. In this talk, I will give an overview about how functional copolymers can be used to tailor paper substrates in a fashion suitable for different applications from paper based microfluidics to sensors and actuators. In addition I will show that by using simple and established papermaking technologies, it is possible to design fluidic timers for microfluidic applications. In brief, lab-sheets consisting of different fiber sources (eucalyptus sulfate and cotton linters pulp) and varying porosities are being designed and further modified with small millimeter-scaled channels using hydrophobic barriers consisting of fiber-attached, hydrophobic polymers. Parameters that influence fluid flow in such papers such as fiber source, paper grammage, and channel width on the flow rates through the channel were studied. I will show that our results suggest that accurate control of fluid transport processes with standard filter papers is complex, however, by controlling the paper sheet porosity through varying the density of the fibers in the sheet, affords the fabrication of chemically identical sheets whereby capillary flow can be modulated over a broad range of technically important flow rates.