

Towards 'Lab-on-papers' and other affordable paper-based devices

Prof. Martin Thuo

Department of Materials Science Engineering

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Abstract

Interest in development of affordable sensors and analytical tool led to the emergence of lab-on-chip devices. A significant jump in this effort was catalyzed by advent of soft-lithography. Recent needs for sustainable and/or frugal sensors and analogous devices has led to emergence of affordable flexible substrates like paper. A major caveat with these substrates is the inability to automate fluidic transport especially in capillary driven systems. Sensitivity to heat implies that incorporation of well-known electrical components is nearly impossible since they cannot be soldered onto the substrates. To mitigate these challenges, first, we developed affordable methods of controlling fluid flow on paper substrates by tuning hydrophobicity leading to reliable paper-based MEMs. We then extended this work to the so called 'draw-your-assay' technique to allow for affordable and on-site device fabrication. To supplement the controlled wetting, we developed a two-way valve that allows for automated and programmable delivery of fluids across multiple channels, opening the door for 'lab-on-paper' devices. In a second effort, we focused on integration of conventional electronic components in the fabrication of devices on flexible substrates. To achieve this, we developed heat-free solders that can be activated by mechanical or chemical stimuli. This development enables rapid prototyping of electronic devices on flexible substrates either by drawing ('scribe-a-circuit') or screen printing. This talk will discuss these advances and their potential effect in frugal innovation.

Since 2014, Martin Thuo has been an Assistant Professor in the Department of materials science and engineering at ISU. He received his Ph.D. from University of Iowa in 2008. He then worked as a Mary-Fieser (2009-2011) and NSEC (2011-2013) Fellow at Harvard University under the tutelage of Prof. George M. Whitesides. He is the recipient of a number of awards like the Lynn-Anderson research excellence award (2008), and Black & Veatch faculty fellowship (2014) among others. His research interests encompass the general theme of frugal innovation through simplicity

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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