



Plastic-based Nanofluidic Sensor for the Detection of Rare Nucleic Acids and Determining Their Sequence Variations from Liquid Biopsy Markers

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Abstract:

Liquid biopsy markers (circulating tumor cells, CTCs; extracellular vesicles, EVs; and cell free DNA, cfDNA) are becoming popular to manage a variety of cancer-related diseases due to the minimally invasive nature of their acquisition. However, the challenge with liquid biopsy markers is their rarity. Because platforms like next generation sequencing require >30 ng of input DNA, significant amounts of amplification of the input are required that can generate a biased representation of the genome. To mitigate this issue, we have produced a mixed-scale nanofluidic sensor featuring a baffle area, high surface area pillar arrays, and nanometer flight tubes (see Figure 1) (1). The pillar arrays can perform solid-phase ligase detection reactions (spLDRs) to score the presence of DNA mutations (<1 ng), but does not require PCR. The spLDR can also expression profile mRNAs following reverse transcription. Successfully formed spLDR products are identified using a molecular-dependent time-of-flight (TOF) through a polymer nanofluidic channel flanked by two in-plane nanopores (2). The nanofluidic sensor was fabricated from a Si master patterned using a combination of focused ion beam (FIB) milling and photolithography with inductively coupled plasma reactive ion etching. The Si master was used to produce resin stamps that were then used to transfer the relevant structures to a plastic via thermal nanoimprint lithography (NIL). The operational features of the device will be presented as well as detecting point mutations in KRAS genes from CTCs' genomic DNA as well as mRNA expression profiling

Biography:

Professor Soper is currently Foundation Distinguished Professor in Chemistry and Mechanical Engineering at the University



of Kansas, Lawrence. Prof. Soper also holds an appointment at Ulsan National Institute of Science and Technology in Ulsan, South Korea, where he is an Adjunct Professor. He is also serving as a Science Advisor for a number of major worldwide companies. Prof. Soper is currently the Editor of the Americas for the Analyst. Prof. Soper is the Director of a NIH sponsored biotechnology center (Center of BioModular Multi-scale Systems for Precision Medicine).

Recent Publications:

- Steven A. Soper, Anal Chem. 2020
- Steven A. Soper, Hum Mutat. 2020
- Steven A. Soper, Anal Chem. 2019
- Steven A. Soper, Lab Chip. 2018
- Steven A. Soper, Cancer J. 2018

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