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Temperature Controlled Phase-Change Valves for Disposable Nucleic Acid Amplification on Paper

Automated, paper-based nucleic acid testing uses thermally actuated phase-change material valves to enable low-cost, minimal complexity, point-of-care pathogen detection.

A nucleic acid amplification test is a molecular technique used to detect viruses or bacterium. Existing nucleic acid amplification assays, even those on paper, require multiple, user-activated steps to move the sample from sample preparation to amplification and then to detection subsystems. These user-initiated steps are points of potential error that can result in sample contamination and the uncontrolled timing of amplification reactions. Because of these complications, such tests will not obtain FDA CLIA wavers to be used at the point of care in their current forms.

Researchers at Purdue University have developed temperature controlled valves for the paper-based isothermal amplification of nucleic acids. This process is a low-cost, disposable method to detect biological pathogens when combined with simple visual lateral flow detection strips. Whereas existing assays require user involvement, researchers developed temperature actuated valves made from phase change materials to automate the fluidics within the device. By automating the fluidics, these tests can be designated as "minimal complexity" as required for truly point of care diagnostics.

Advantages:

-Independent of environmental humidity

-Thermally actuated valve

Potential Applications:

-Pathogen detection

TRL: 6

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Provisional-Patent, 2016-04-19, United States | PCT-Patent, 2017-04-19, WO | NATL-Patent, 2018-10-19, United States | CON-Patent, 2021-04-19, United States | DIV-Patent, 2021-08-13, United States | CON-Patent, 2023-04-14, United States

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