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Integrating Systems for Liquid/Substrate Characterization and Functional Printing

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ABSTRACT

Gallium-Indium alloys are recently applied in fabricating soft devices, such as stretchable sensors, electric circuits, micro pumps and optics. Its printability demonstrates the possibility for a wide extension of the application. Current fabrication methods are inefficient when printing is most handled manually, and are highly dependent on material properties. There is need for a fast way to characterize material properties, and to functionally print the given shape on the substrate. This paper presents the construction of an efficiently integrated system with optical imaging and functional printing for Gallium-Indium alloys. The imaging section allows for characterization of material properties to fast and accurately determine printing parameters in printing section. A new algorithm, which extends generalized Hough Transform, is designed to determine the contact angle of sessile drops by fitting the shape based on Bashforth-Adams equation. The results are later applied in determination of featured geometry in printing. The algorithm shows relatively low errors in profiling the sessile drop shapes. However, the results are not stable for 5% of test pictures, and thus revisions are still needed. In addition, functional printing is finalized with a direct writing module and a friendly user interface. A series of the state-of-the-art algorithms are adopted in image analysis and controlling. Test printing shows its workability, flexibility and accordance to the previous work. The integrated system presents a solution for both accuracy and efficiency in Gallium-Indium alloy printing.

KEYWORDS

Gallium-Indium alloy, image processing, Hough transform, contact angle, functional printing