Response to Reviews on Manuscript: JoVE58546:

We thank the reviewers for the time invested in reading and commenting on our manuscript. Both reviewers recommend the paper for publication with revisions/clarifications. We present below a point-by-point response to their comments. The revisions in the manuscript are highlighted in green (for major revisions) and highlighted in yellow (for minor revisions).

Editorial Comments:

1. *Please take this opportunity to thoroughly proofread the manuscript to ensure that there are no spelling or grammar issues. The JoVE editor will not copy-edit your manuscript and any errors in the submitted revision may be present in the published version.*

***Response 1***: The manuscript was checked and revised for spelling and grammatical issues.

2. *Please complete and sign the Author License Agreement (ALA) and upload it to your Editorial Manager account.*

***Response 2***: The ALA has been completed and will be uploaded to the Editorial Manager account.

3. *Figures: Please use color for panel labels and other labels for better contrast.*

***Response 3*:** The colors for the labels have been added to create better contrast and to create more clarity in the figures.

4. *Please rephrase the Long Abstract to more clearly state the goal of the protocol.*

***Response 4***: The abstract has been revised to emphasize the broader impacts and goals of the protocol/apparatus.

5. *A schematic of the stamping apparatus as Figure 1 would greatly aid in the protocol.*

***Response 5*:** A new Figure (Fig.1) has been created that provides the reader with a side view schematic of the stamping apparatus, providing better protocol/apparatus clarity for the reader. Figure 1 has been placed on Page 6 at the beginning of the “Representative Results” section.

6. *3.1.1-3.1.2: Please write the text in the imperative tense.*

***Response 6*:** Statements 3.1.1 and 3.1.2 in the protocol have been edited to the imperative tense on Page 3.

7*. References: Please do not abbreviate journal titles. Please include volume and issue numbers for all references.*

***Response 7*:** All journal titles have now been written out in their entirety and the volume and issue number have been included (when the journal has provided an issue number. References 8 and 11 did not have an issue number.) in the reference list of the revised manuscript.

Reviewer: 1

*There appears to be some degree of confusion about hydrophobic vs. hydrophilic throughout the manuscript. In the introduction, the term hemiwicking is described in terms of hydrophobic structures, when in fact hemiwicking usually refers to hydrophilic structures. Another example is characterizing deposited Al as hydrophilic; in fact, it is the aluminum oxide (which immediately forms on the Al surface) that is the material responsible for hydrophilic properties. In another instance, the discussion of Fig 3 notes that "If water is desired as the working fluid, another process, such as creating a layer of hydrophilic self-assembled monolayers must be added to the process." This makes no sense -- both water and ethanol are hydrophilic solvents, and the aluminum oxide is already hydrophilic. Did the authors mean a hydrophobic surface example (as in reference #15)? The reference cited (#17) does not seem directly relevant here.*

***Response 8***: The manuscript abstract and introduction has been significantly modified to avoid misuse of the terms hydrophilic and hydrophobic with respect to hemiwicking structures.

With regard to the discussion of the wicking of ethanol on Page 7, it is true that the aluminum oxide layer that forms on top of the deposited aluminum serves as a ‘philic’ (or lyophilic) surface for the wetting of ethanol. Tests performed with ethanol and water droplets on the Al/Al2O3 surface coatings on the PDMS. Ethanol wetted the surface ( 70), while the water did not (90). Therefore, in terms of distilled liquid water at room temperature and standard pressure, the pillars are hydrophobic. Therefore, for micro-pillar wicking with aqueous fluids a hydrophilic surface coating is needed on the stamped PDMS surface (or the metal-coated stamped PDMS surface). In this regard, the addition of hydrophilic self-assembled monolayers (SAMs) to the pillared PDMS surface will enhance the wicking velocity with aqueous fluids. The discussion section has been modified to address that 1) the Al coating was hydrophobic and 2) the need for other surface coatings for wicking with water and other high surface tension fluids. Also, with regard to the SAMs, the discussion was rewritten to address that different SAM chemistries can both make surface either more hydrophilic or more hydrophobic (see, Pg. 7).

*Reference selection is weak. There's a lot of literature about hydrophilic/hydrophobic/hemiwicking surfaces -- the authors should add some of the most authoritative ones.*

***Response 9*:** Additional sources (Reference 1 and 2) have been used for reference when discussing the importance of thin-film regions in the field of heat transfer on Page 2. Also, the reference selection has been edited to improve the quality of the references used for the paper.

Reviewer: 2

*Overall script is poorly written. Experimental protocol is not properly defined/ elaborated. The figures are clear at all! Their captions are very confusing; Figure 1 (a) say 'the pixel distance for the image was 100 μm/pixel; and the pixel distance for 1 (b) and 1 (c) is 0.335 μm/pixel. What does this mean? The pitch of the pillars seams to be about 200 microns. All the terminologies to be defined properly and figures need to be labelled adequately.*

***Response 10a*:** Section 2 of the protocol was rewritten to clarify the process. Other minor edits have been made to Sections 3 and 4 on Pages 3 through 5 in order to be clearer about the stamping and molding of the PDMS sample. Figure 1 has been added with the schematic of the stamping apparatus on Page 6 to add more clarity and define more of the terms that are used in the protocol.

*Figure 1 (a) say 'the pixel distance for the image was 100 μm/pixel; and the pixel distance for 1 (b) and 1 (c) is 0.335 μm/pixel. What does this mean? The pitch of the pillars seams to be about 200 microns. All the terminologies to be defined properly and figures need to be labelled adequately.*

**Response 10b:** Regarding the captions of the revised Figures 2 and 3 (previously Figures 1 and 2, respectively); the phrase “the pixel distance for the image was 100 μm/pixel” was changed to “and each pixel was set to represent a distance of 100 μm” on Page 7 in order to clarify that the ‘pixel distance’ represents the practical distance the stepper motors move the drill bit from pixel to pixel. For instance, Figure 3(a) shows an alternating pattern for the pixel array with each pixel set to represent a distance of 100 μm. Since every other pixel is white, the bit will imprint a cavity on the plastic mold every 200 μm since the distance from one black pixel to the next is two pixels.

*The measured height of the pillars indicated in Table 1 and 2 is obtained from how many measurements? Kindly indicate the number of data points taken for each height indicated.*

**Response 10c:** The number of pillars measured for the data provided in Table I and Table II were 50 and 38, respectively. This information has been added on Pages 6 and 7.

*The measured height of the pillars are less than 60% of the height expectations. How the authors propose to improve it.*

**Response 10d:** In the discussion section on Page 9, the middle paragraph has been rewritten to discuss how to improve the stamping height precision. This discussion focuses on the deflection/displacement of the plastic mold as the bit creates the cavity. This mold deflection/displacement leads to a reduced pillar height. We counteract this issue by setting the stamp depth to a value greater than the desired pillar height. A second potential solution is to increase the temperature of the bit (using more laser heating power) such that the plastic mold heated more toward its glass transition (melting) temperature during the drill bit stamping process.