**Dome-shape calculation for the gradient height of concentric hydrogels.**

The calculation for the dome shape can be done by the geometry in Figure S-1. Assume the dome can be fitted by a circle. Because the diameter of the PDMS dome is 12 mm that is demolded from the PMMA mold in Figure 1, the radius of the dome is 6 mm. Therefore, the curvature of the PDMS dome is *H(x)* = *y(x)* - *(r- H0)*.

The pink triangle is a rectangular triangle, so

Because the dome shape is a part of a circle, so

The volume (***V***) of over injection volume in blue region in Figure S-1 can be integrated by the following equation:

Bring the equations into the above equation, and then the equation between volume (***V***) and the max height (***H0***) of the dome is as below:

In the manuscript, the over injection volume is 40 μL. Therefore, the max height (***H0***) of the dome is 0.651 mm, and ***r*** equals to 27.975 mm. Bring the values into and *H(x)* = *y(x)* - *(r- H0)*, the relationship between ***H(x)*** and ***x*** is as below:

The ***x*** represents the radius of the concentric hydrogels. Therefore, bring the radius of each hydrogel into the above equation, and then ***H(x)*** can be obtained. For the height of each hydrogel under the 40-μL volume injection, it should be added extra 300 μL of the height in the flow channel (the white area in Figure S-1).



**Figure S-1**. Calculation of the dome-shape PDMS curvature. ***H(x)***: the convex PDMS curve; ***H0***: the maximum height difference of the PDMS dome before and after deformation; ***r***: the radius of the dome; ***V***: the over injection volume of the blue region which causes the PDMS deformation as a dome.

**Table S-1**. The height of each hydrogel under the dome with 40 μL volume injection. Unit: mm

|  |  |
| --- | --- |
|  | **Hydrogel line** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **x** | 1.1 | 1.5 | 1.9 | 2.3 | 2.7 | 3.1 | 3.5 | 3.9 | 4.3 | 4.7 | 5.1 | 5.5 |
| **H(x)** | 0.629  | 0.611  | 0.586  | 0.556  | 0.520  | 0.479  | 0.431  | 0.378  | 0.319  | 0.253  | 0.182  | 0.105  |
| **Height of hydrogel** | 0.929  | 0.911  | 0.886  | 0.856  | 0.820  | 0.779  | 0.731  | 0.678  | 0.619  | 0.553  | 0.482  | 0.405  |