Electronic Supplementary Information

Anisotropic Liquid Penetration Arising from Cross-Sectional Wettability Gradient

Xuelin Tian\textsuperscript{1*}, Juan Li\textsuperscript{2}, Xian Wang\textsuperscript{1}

\textsuperscript{1}Xinjiang Key Laboratory of Electronic Information Materials and Devices, and \textsuperscript{2}Key Laboratory of Plant Resources and Chemistry of Arid Zone, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Urumqi 830011, China

Email: tianxl@ms.xjb.ac.cn
Figure S1  Anisotropic liquid penetration under a) high, b) moderate and c) low wettability gradient with quadratic dependence between $\theta(\phi)$ and $\phi$.

![Graphs showing anisotropic liquid penetration for high, moderate, and low wettability gradients](image)

The left plots show the relationship between $P_c$ and $k$, and the right plots give the relationship between anisotropic ratio ($P_{c-r}/P_{c-p}$) and $k$. A quadratic relationship between $\theta(\phi)$ and $\phi$ is assumed, and $\theta(\phi)$ varies within the range of $[0, \pi]$, $[\pi/6, 5\pi/6]$ and $[\pi/3, 2\pi/3]$ for a), b) and c), respectively. For a), $\theta_p(\phi) = \phi^2/\pi$, $\theta_r(\phi) = (\pi - \phi)^2/\pi$; b),
\[ \theta_p(\varphi) = \pi / 6 + 2\varphi^2 / 3\pi, \quad \theta_s(\varphi) = \pi / 6 + (\pi - \varphi)^2 / 3\pi; \quad c), \quad \theta_p(\varphi) = \pi / 3 + \varphi^2 / 3\pi, \]
\[ \theta_s(\varphi) = \pi / 3 + (\pi - \varphi)^2 / 3\pi. \]
Cylinder radius is assumed to be 100 µm, and water surface tension \( \gamma \) (0.0728 N/m, 20 °C) is used for calculation. It can be seen that the anisotropic ratio \( (P_{c-p}/P_{c-r}) \) can be improved by either decreasing the spacing ratio or increasing the wettability gradient.