

Polymer Nanostructures Using Porous Templates

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Abstract

Template wetting methods have been widely applied in the preparation of one-dimensional (1D) polymer nanomaterials. We study the fabrication and characterization of different polymer-related nanomaterials by wetting porous templates. The templates we choose are anodic aluminum oxide (AAO) templates because of the regular pore distribution, high pore density, and high aspect ratio of the pores. Using AAO templates, we report novel smart nano membranes (SNM) by grafting AAO templates with spiropyran molecules. The ultraviolet and visible light responses of the SNM under acid vapors are investigated. Under UV irradiation, the ring-closed spiropyran on the AAO templates transform to ring-opened merocyanine, which contains phenolate oxygen and can be further protonated by acids. We also present a facile light-induced nanowetting (LIN) method to fabricate patterned nanoarrays. Photoresponsive azobenzene-containing polymers (azopolymers) that exhibit light-induced reversible solid-to-liquid transitions are used. Notably, using designed photomasks, the patterns of the nanoarrays can be ingeniously controlled with the characteristic of erasable and rewritable nanostructures. In addition, we demonstrate photoresponsive composite polymer electrolytes, consisting of gel polymer electrolyte (GPE) and spiropyran-immobilized nanoporous anodic aluminum oxide (SP-AAO) templates. We also present versatile and on-demand photocontrollable ionic conductive nanocomposite hydrogels via host-guest chemistry.

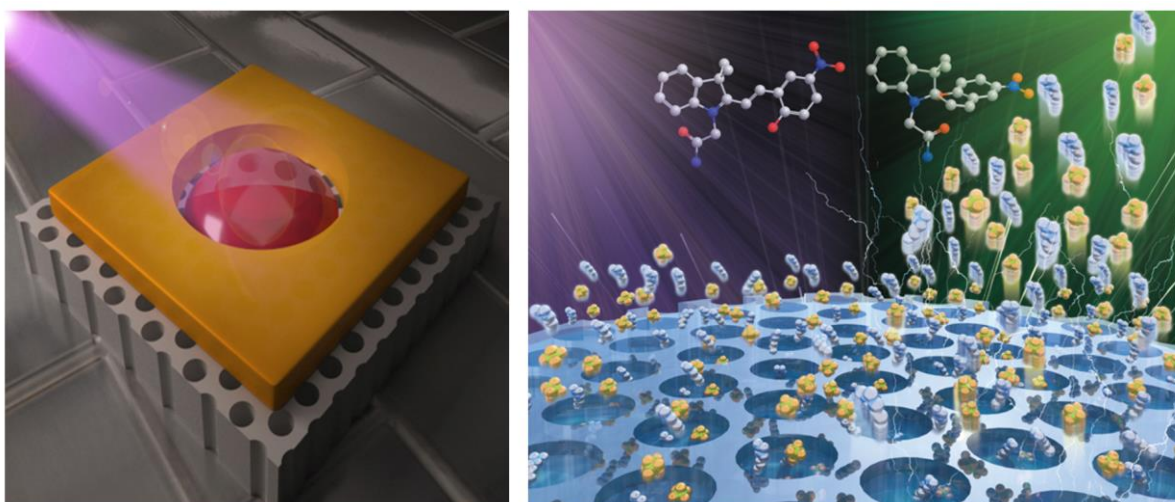


Figure 1. Illustration of the Lin method and light-responsive composite membranes.

References

- [1] S. Zheng, Y. L. Lin, C. C. Chang, M. J. Lee, Y. F. Chen, L. R. Lee, M. H. Chang, and J. T. Chen,* *ACS Appl. Mater. Interfaces*, **2023**, *15*, 45418.
- [2] Y. L. Lin, Y.H. Tseng, J.H. Ho, Y. F. Chen, and J. T. Chen,* *Chem. Eur. J.* **2021**, *27*, 14981.
- [3] Y. L. Lin, S. Y. Tsai, H. C. He, L. R. Lee, J. H. Ho, C. L. Wang, and J.T. Chen,* *Macromolecules*, **2021**, *54*, 2001.
- [4] K. T. Lin, Y. J. Chen, M. R. Huang, V. K. Karapala, J. H. Ho, and J. T. Chen*, *Nano Lett.*, **2020**, *20*, 553.
- [5] M. H. Cheng, Y. C. Hsu, C. W. Chang, H. W. Ko, P. Y. Chung, and J. T. Chen,* *ACS Appl. Mater. Interfaces*, **2017**, *38*, 1600689.