Fabrication of Anisotropic Microstructures by Chemical Gradient-Mediated Evolution Pathways

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We report a facile fabrication method of anisotropic microstructures by using chemical gradient- mediated evolution pathways. Shape effect of microstructures is of great interest recently due to its distinctive biological and physical behaviors in comparison to isotropic microstructures. However, there has been a limitation for shaping the microstructures in three-dimensional manner. In this report, we control the polymer evolution during polymerization by engineering the chemical gradients in the system. It enables dynamic control of shape of polymeric structures and thereby forming three-dimensionally anisotrpic microstructures. To demonstrate this, we fabricated poly (ehthylene glycol) diacrylate (PEGDA) microstructures using photopolymerization. By controlling the oxygen gradients – the radical scavenger – in the system with three different ways, polymer evolution was controlled. According to the oxygen gradient, PEGDA was evolved in three different ways: bottom-to-top, center-to-edge, bottom center-to-top edge. Finally, multi-step photopolymerization enabled fabrication of hierarchical microstructures with higher complexity.