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Geometry in Biomimetic Network: Double Gyroid to Pseudo-Single Gyroid in Nanohybrid Materials HAN-YU HSUEH, RONG-MING HO, Department of Chemical Engineering, National Tsing Hua University Hsinchu 30013, Taiwan, YU-CHUEH HUNG, YI-CHUN LING, Institute of Photonics Technologies, National Tsing Hua University, Hsinchu 30013, Taiwan, HIROKAZU HASEGAWA, Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University, Nishikyo-ku, Kyoto, 615-8510, Japan — Biological systems have developed delicately arranged micro- and architectures to produce striking optical effects since millions of years ago. Inspired by the textures of butterfly wings with single gyroid (SG) structure, herein, we aim to fabricate biocompatible and robust materials with SG-like structure in nanometer size so as to give new materials with unprecedented optical properties for applications. Biommicking from the biological photonic structures of butterfly wings, a double gyroid (DG) structure in nanometer size is obtained from the self-assembly of polystyrene-b-poly(L-lactide) (PS-PLLA). To acquire robust backbone networks, inorganic networks in polymer matrix are fabricated by using the hydrolyzed PS-PLLA with DG structure as a template for sol-gel reaction. Owing to the soft polymer matrix, two co-continuous inorganic networks embedded in the polymer matrix can be rearranged by thermal annealing at temperature above the glass transition of the polymer. Consequently, the rearrangement of these inorganic networks leads the formation of SG-like structure possessing unique nanohybrids with ordered texture. This unique nanomaterials with SG-like structure is referred as a pseudo-SG (p-SG) nanohybrids.

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