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# Germanium-dioxide periodic nanostructure from inverse replication of butterfly wings

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**Abstract:** A photonic crystal can be used for controlling light propagation by defining a photonic stop band that is decided by both the periodic structure and material. In this study, the photonic structure in butterfly wing was inversely replicated with germanium dioxide through a facile liquid phase deposition process. Precise replicas of both micro-tile array and dispersed micro-cubes were produced by adjusting the depositing conditions. This work provides the possibility that the abundant photonic crystals in nature can be further enriched by combining the merits of both artificial tailoring and constituents.

**Keywords:** Photonic structure; deposition; germanium dioxide; butterfly wing; optical materials and properties.

## 1. Introduction

Nature provides abundant selections of photonic related micro- to nanostructures [1-6], which can be used as templates or prototypes for fabricating a wide range of structures for controlling light propagation. Artificial structures inspired from natural species may combine the merits offered by both the biological structures and constituents, and thus exhibit much stronger capability than nature for designing functionalities. On the one hand, the biological structures could be tailored by adjusting synthetic parameters [7,8], and even a doubled number of structural type could be obtained through inverse replication [9-11]. On the other hand, in contrast to limited biopolymers (such as polysaccharide chitin and keratin) in biological materials, millions of elements and

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