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Structural analysis of three-dimenstionl photonic crystals in nature[1] BEOM-JIN YOON, JUNG OK PARK, MOHAN SRINIVASARAO, School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta, GA
— We studied the structural origin of the color and photonic band structure in exoskeletons of Eupholus weevils and dorsal wings of lycaenids butterflies. The internal structures of the insects were systematically investigated using focused ion beam (FIB) milling, and the optical response of the insects was observed by optical microscopy and a microspectrophotometer. A series of sequential SEM images were obtained during the FIB milling process and 3D structures were reconstructed by image processing. The correlation of the structures and the optical responses were studied by theoretical modeling. Diamond-based 3D photonic crystal lattice existed in Eupholus weevils, while gyroid structure was in lycaenids butterflies. The calculated photonic band structures matched the measured optical response. Aluminum oxide and titanium oxide were deposited on the weevils and the butterflies in order to study the effect of refractive index contrast to the photonic band structure and the optical response.

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