Fabrication of photonic paints based on block-copolymer microparticles

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Due to their brightly colored appearance and non-fading nature, structurally colored animals have attracted a lot of attention throughout the scientific community. Consequently, bioinspired materials have enjoyed a lot of development in recent years. In this context, photonic pigments, which consist of micron-sized particles displaying intense structural coloration based on light-matter interactions provided through precise nanostructures, are assuming an increasing deal of interest. These photonic pigments could be considered as a new generation of coloration pigments. Their non-fading colors could be the solution to the traditionally encountered over-time fading of either metal- or organic-based pigments. To achieve such optically active particles, concentric lamellar microspheres with alternative layers of high and low-refractive materials were prepared via an emulsion-based confined self-assembly of a linear AB-type block-copolymer. By mimicking a Distributed Bragg Reflector, the concentric lamellar microspheres display structural coloration via the interaction between their periodic nanostructure and incident light. By a layer-specific addition of a high refractive index organic molecule and another counter-balancing swelling agent, the photonic band gap could be tuned to yield any color in the visible spectrum. To increase the color vibrancy, the incoherent light scattering of the photonic microspheres was reduced with the addition of a black dye. Finally, different photonic paints were successfully produced and optimized, yielding an innovative, robust, tunable, and scalable coloration method.

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