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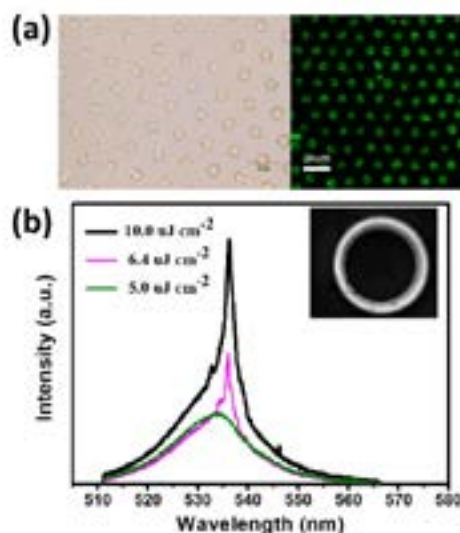
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Size-tunable CsPbBr₃ perovskite ring arrange for stable and ultralow threshold laser

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Owing to the long carrier lifetimes and diffusion lengths, the high photoluminescence (PL) quantum yield, and the stoichiometric wavelength tenability, CsPbX₃ (X = Cl, Br, I) perovskite nanocrystals are extensively applied in various optoelectronics, especially for laser. Recently, perovskite microscale crystals with different morphology, such as spherical, rectangular and hexagonal, have been prepared for whispering gallery modes (WGM) lasing. In this work, we prepared the high quality size-controlled and periodic perovskite hollow ring arrays by a facile microsphere template lithography technology. The common feature for these works is the use of solid crystals as the optical gain media, which may cause more resonating modes and large threshold due to the presence of multiple transportation path of the light. Up to now, it still lacks related reports about the hollow structure of perovskite microscale crystals for WGM lasing applications. In comparison to single hollow perovskite structure, the periodic array of hollow perovskite structures have not only the merits of single hollow structure but also additional collective properties, for instance interference of stimulated radiation, due to the interactions of different hollow structures, and hence available in laser array source, array sensing, and so on. The diameters of as-prepared perovskite rings can be tuned continuously from 2.6 μm to 16.9 μm by selection of template spheres with different size or additional annealing treatments. Besides, optically pumped room temperature WGM lasing with single mode and low-threshold (~6 μJ cm⁻², lower than most solid microscale perovskite crystals) from individual perovskite hollow ring and the coherent radiation from perovskite microring array were obtained.



(a) Micrograph(left) and confocal laser scanning microscope image(right) of perovskite ring with size of 2.6 μm;

(b) Emission spectra of perovskite ring with size of 9.8 μm excited by diverse pump density. Inset SEM image taken from the CsPbBr₃ rings.

Biography

Jingkun Xu come from Anhui province of China. He is Optical Engineering PhD of advanced photonics center, southeast university.

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