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Self-assembled single-mode micro-lasers of "giant" CdSe/CdS core/shell quantum dots CHEN LIAO, JIAYU ZHANG, Advanced Photonic Center, Southeast University — So-called giant quantum dots (g-QDs) as optical gain media have attracted much attention due to their near elimination of nonradiative Auger effects. In the present work, phase-pure wurtzite CdSe/CdS core/shell QDs with controlled shell thickness are successfully synthesized, and the threshold of amplified spontaneous emission (ASE) of the films of this series of QDs is measured. The threshold of ASE is decreased dramatically with the CdS shell growth towards 11 monolayers (MLs) (21 μJ/cm^2), but increased with the further shell growth. The effects of the overlap degree of electron and hole wave functions, surface states, and absorption cross-section are discussed to explain the ASE properties of the QDs. Moreover, the low-threshold gain of the CdSe/CdS core/shell (11 MLs) g-QDs is exploited to fabricate micro-lasers solely by deposition of small droplets of QDs solution onto glass substrates. The evaporation dynamics of the droplets are governed by the coffee-ring effect which leads to the formation of well defined micron-size rings. The self-assembled coffee-ring micro-lasers display single-mode operation and a very low threshold of 3 μJ/cm^2. Herein, an innovative, simple and reliable method to produce micro-lasers based on CdSe/CdS g-QDs is presented.

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