The study on optofluidic fluorescence resonance energy transfer lasing in a PDMS microfluidic channel

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**Abstract**

A bare quartz fiber with single refractive index is implanted in a polydimethylsiloxane (PDMS) microfluidic channel, the circular cross section of the fiber forms a ring resonator and has high quality (Q) whispering gallery modes (WGMs). The lasing gain media consists of fluorescence resonance energy transfer (FRET) donor-acceptor dye pair, which is Rhodamine B (RhB)-LDS821 mixture solution with a lower refractive index than that of the optical fiber, the solution acts as the cladding liquid material and flows in the PDMS microfluidic channel. Pumping along the optical fiber axis, the FRET characteristic parameters have been studied firstly by using a continuous wave laser as a pump light with a wavelength of 532 nm. Then the excited states are created in the donor (RhB) by using a pulse laser and transferred to the adjacent acceptor (LDS821) through FRET, whose emission is coupled into the WGMs. Due to high energy transfer efficiency of the donor-acceptor dye pair used, and high Q-factor WGMs of the ring resonator, the built laser in the microfluidic channel shows a lasing threshold as low as 1.26 μJ/mm2.

**Keywords**: optofluidic laser, fluorescence resonance energy transfer, evanescent wave