Fabrication of nanofiber Bragg cavities using a Neon ion beam

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In order to realize photonic quantum information technologies, it is important to develop photonic quantum devices, such as single photon sources, quantum memories, and quantum phase gates. For these devices, we have developed nanofiber Bragg cavities (NFBCs), which are the optical nanofibers embedded an optical cavity in it using a gallium focused ion beam (FIB), and realized about 3 times enhancement of photon emission from single quantum dot when the quality (Q) factor is about 300 [1]. We have also theoretically clarified that the NFBCs can realize coupling efficiency over 80% from the single light emitter to a single mod fiber and efficient excitation of the single light emitters via the optical fiber [2, 3]. To improve the Q factors, we have recently fabricated them using a helium FIB [4]. However, when using the He FIB, the NFBCs were fragile and sometimes broken during transportation. This would be due to the damage to the nanofiber by the He ions.

In order to address this issue, we have fabricated the NFBCs using a Neon ion beam. This beam is periodically irradiated from the top side of the nanofiber [1, 4]. Figure 1(a) shows a scanning ion microscope (SIM) image by the Ne beam. The periodical structure is carved on the nanofiber. Figure 1(b) is the measured transmission spectrum of this NFBC. We are able to observe a sharp resonant peak with the Q factor of 390, which is higher than the Q factor when the NFBC was fabricated using the Ga FIB.

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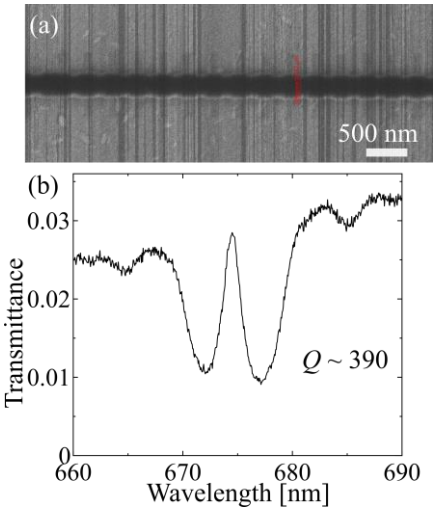

Fig. 1 (a) The SIM image of the fabricated NFBC. (b) Transmission spectrum of the NFBC.

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