Microfabricated Cs vapor cells filled with an on-chip dispensing component

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We present a recent progress on a wafer-level microfabrication technique for MEMS vapor cells, filled with cesium (Cs) from an on-chip dispensing component in the cell (Fig. 1 [1]). Wafer-level cell fabrication with an alkali metal dispenser has gained considerable attention for contributing to the high performance of miniaturized atomic devices. However, the large size of the dispenser and released residual gases can be limitations to miniaturization and the stability of atomic vapor [2]. We proposed a cell structure that overcomes these limitations and offers a single-mask process with typical Si-based microfabrication at the wafer-level. The cell consists of an optical cavity connected to a Cs-dispensing component via microchannels. Microfabricated Si grooves with multiple re-entrant microstructures are employed for effective Cs production from cesium azide (CsN_3) [3]. In our experiment, Cs was successfully filled in a cell by heating at 330 °C for 10 min. The temperature and time were lower and shorter than those of conventional production methods [4-5]. The stability of the Cs atomic density in the cell was confirmed over a period of 6 months. These results confirm the potential of this technique for the fabrication of low-drift cells because the combination of the Si microstructure and the low-temperature process enable the reduction of outgas inside the cell.

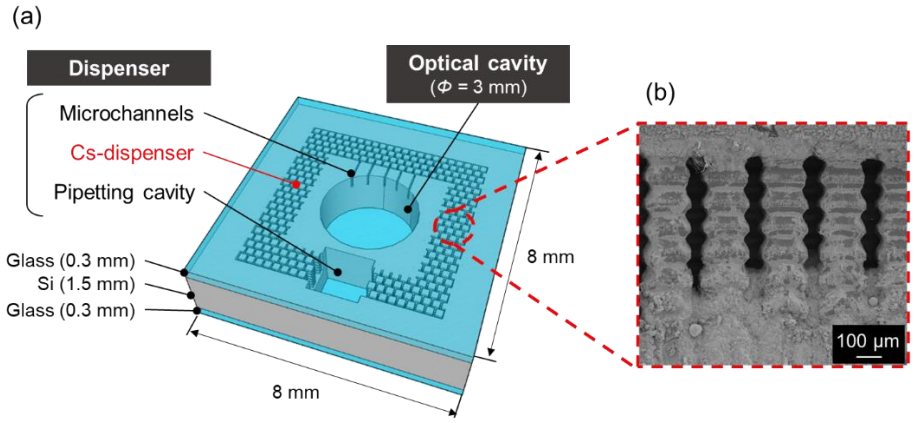

Figure 1. (a) Schematic illustration of alkali metal vapor cell fabricated from a 1.5 mm-thick Si wafer and two 0.3 mm-thick glass wafers. (b) A SEM image of cross section of Cs dispenser area in the cell.

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