Silicon-based micro-reactor for preferential CO oxidation

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One of the methods to generate the H_2 fuel for polymer electrolyte membrane fuel cell (PEMFC) is the steam reforming of methanol. Typically, reformed gas from methanol steam reforming has contained 0.5~1 vol% CO. The trace amount of CO must be reduced below 10 ppm because the Pt active site of Pt-based anode catalyst of PEMFC is easily poisoned by CO at low temperature. The effective way to reduce the 0.5~1vol% CO concentration is the preferential CO oxidation. In this study, for the application in small PEMFC to the portable devices, a micro-reactor for preferential CO oxidation (micro-PrOx) was fabricated on 500 um thick p-type (110) silicon wafer by micro electro mechanical system (MEMS) and silicon micromachining technology. Micro-PrOx had 17 parallel channels with 600 um width, 240 um depth, and varying in the channel lengths. Pt/Al_2O_3 catalyst (Johnson Matthey) was used in the experiments and the new method in catalyst coating (fill-and-dry coating) was introduced to coat the inner walls of micro-channels of pre-assembled micro-reactor. We investigated the effect of lambda (O_2/CO ratio), feed rate, and channel shape on the performance of micro-PrOx at the various temperatures from 190 to 300℃.