The catalytic reaction of CO$_2$ reforming of CH$_4$ produces synthesis gas (CO and H$_2$), which is useful as a feedstock for many industrial processes. In the past few years, many transition metal-based catalysts have been investigated but the major problems reported were catalytic deactivation due to carbon deposition and low yield. We studied the CH$_4$/CO$_2$ reforming over La$_2$NiO$_4$ and 10%NiO/CeO$_2$-La$_2$O$_3$ catalysts under the condition of supersonic jet expansion via direct monitoring of the change in reactants (CH$_4$ and CO$_2$), product (CO) and side-product (H$_2$O) using the sensitive technique of cavity ring-down spectroscopy. Vibration-rotational absorption lines of CH$_4$, H$_2$O, CO and CO$_2$ molecules were recorded in the near infrared spectral region. We found that La$_2$NiO$_4$ is superior to 10%NiO/CeO$_2$-La$_2$O$_3$ in performance. We have also investigated the associated reverse water-gas shift (RWGS) reaction, which affects significantly the H$_2$/CO product ratio, over the catalysts during CH$_4$/CO$_2$ reforming. Our results indicated that the RWGS reaction promoted the conversion of CO$_2$ and decreased the partial pressure of hydrogen. By proper adjustment of the pressure of the reaction system, it is possible to suppress the occurrence of RWGS reaction and increase the selectivity of CH$_4$/CO$_2$ reforming.