CH_4/CO_2 REFORMING OVER La_2NiO_4 AND 10 PERCENT NiO/CeO_2-La_2O_3 CATALYSTS UNDER THE CONDITION OF SUPERSONIC JET EXPANSION VIA CAVITY RING DOWN SPECTROSCOPIC ANAYLSIS

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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_2NiO_4 and 10%NiO/CeO_2-La_2O_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_2O) using the sensitive technique of cavity ring-down spectroscopy. Vibration-rotational absorption lines of CH_4, H_2O, CO_2 and CO molecules were recorded in the near infrared spectral region. We found that La_2NiO_4 is superior to 10%NiO/CeO_2-La_2O_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.