Characteristics of methane reforming by using an arc plasma process

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ABSTRACT
In order to produce synthesis gas, reforming of biogas composed with 60 percent for CH4 and 40 percent for CO2 was performed by a novel rotating arc plasma process. The effects of O2/CH4 ratio and specific energy input on the conversion, syngas composition and energy cost were investigated to evaluate the performance of AC-pulsed arc plasma process compared with conventional gliding arc plasma process. When the O2/CH4 ratio was increased from 0.4 to 0.9, the conversions of CH4 and O2 increased up to 97.5 percent and 98.8 percent, respectively, while CO2 conversion was nearly constant to be 38.6 percent. This is due to more enhance the partial oxidation of CH4 to CO and H2 than that of dry reforming by increasing the O2/CH4 ratio. In this work, energy cost of 32 kJ/mol was achieved with high syngas composition of 71 percent using pure O2 as oxidant reactant. These are lower than those of different arc plasma processes (energy cost of 122 - 1870 kJ/mol) such as spark, spark-shade and gliding arc plasma. Because, this rotating arc plasma can remain in a long arc length and a large volume of plasma with constant arc length mode.