A Study on Control System for the Oxidative Steam Reforming of Methanol

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The polymer electrolyte membrane (PEM) fuel cells have an advantage in that they are light-weight and can operate in low temperatures. The hydrogen required for the PEM fuel cells can be produced from liquid organics through reforming processes. Among them, Methanol offers several advantages in that methanol is easy to obtain and the methanol reforming reaction can take place at low temperatures. The Oxidative Steam Reforming of Methanol (OSRM) contains O2 as a reactant, unlike The Steam Reforming of Methanol (SRM). The OSRM is highly exothermic and CO byproduct formation is high. Due to the exothermicity of the OSRM, less external heating of a reactor and less operating time are required, but, CO formation has a negative effect on the performance of fuel cells; therefore controlling the O2 entering the process properly is necessary. In this study, I analyzed the dynamic behaviors of the process in relation to oxygen levels. As a result, the multi-steady state phenomenon with hysteresis was observed. Taking this into consideration, I have designed an OSRM Control System to gain the desired reaction temperature and conversion rates by manipulating the amount of O2.