Production of high purity methane through a sorption enhanced methanation process

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Synthetic natural gas (SNG) produced using renewable energy offers a potential solution for the transition to net-zero emissions for sectors that are reliant on natural gas. One promising route for the production of SNG is the sorption enhanced methanation (SEM) process in which the steam generated from the methanation reaction is removed from the gas phase by means of an H_2O adsorbent that has been mixed with the catalyst, thus pushing the reactions towards the production of CH_4. In this way, high CH_4 purities can be reached under less stringent conditions of temperature and pressure, and in a lower number of stages. The objective of this work has been demonstrating the potential of using a commercial Rh-based catalyst and a zeolite 5A in a SEM process. The operating conditions required for the production of pure CH_4 have been discussed for both CO and CO_2 methanation reactions under SEM conditions using these materials. Moreover, multiple SEM/regeneration cycles have been performed, for demonstrating the reproducibility of the results obtained. Pure CH4 production has been possible operating at 275 ºC and atmospheric pressure under CO_2 SEM conditions whereas for CO SEM the CH_4 purity fulfilled under the same conditions of temperature and pressure has been lower.