

Ortho-Para hydrogen convertor design for a 0.5 TPD scale of hydrogen liquefaction plant

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Before design of ortho-para hydrogen converters the 0.5 TPD scale of hydrogen liquefaction cycle consisting the appropriate components such as several heat exchangers, He compressing-expansion cycle, and three O-P hydrogen convertors was already determined and all temperature and pressure at inlet and outlet of each component were also obtained by using ASPEN HYSYS V11 and NIST REFPROP 10.0 of physical properties. Since ortho-para hydrogen converting process is exothermic reaction the convertor is normally accompanied by LN2 pre-cooler in hydrogen liquefaction plants. Important parameters to design O-P hydrogen convertors are the pressure drop and the heat transfer area to cool the heat generation during O-P hydrogen converting. The pressure drop can be found the equation suggested by Zhuzhgov et al. Here, the void fraction for spherical-shape ferric hydroxide catalyst packed in the O-P hydrogen convertor is almost 0.4. The heat transfer area can be calculated by using Re and Nu for mass flow rates of gas hydrogen. Eventually the dimensions of the three ortho-para hydrogen converters were suggested respectively.