I am trying to find the partial pressure of ethylene for this equation. The reaction is ethylene polymerization, i.e., ethylene to products which is first order in partial pressure of ethylene:



The flow rate of 5% ethylene/He (balance) in gas phase is 50 mL/min for a small laboratory downward reactor tube made up of quartz. I don’t know the roughness factor but I think you can approximate it to be a certain number. The length of the reactor tube is 8 inches (20.32 cm) and the diameter is 0.20 inches (0.5 cm). It is heated both internally and externally to uniformly maintain the desired temperature (25-500 °C). It is operated at atmospheric pressure, i.e., without any other pressures than the flow of the reactant gas in this downward flow. You can use the ideal gas law approximation and assume 22.4 L/mol unless you can find a better approximation. I don’t think friction will be important as well.

I can get r (reaction rate) in the above question from conversion of ethylene to products normalized with the weight of the catalyst.

Now my question is how to get partial pressure of ethylene (in units of pressure such as torr or psi) in these reactors and flow configurations? I presume I can change partial pressure of ethylene by changing the flow rate?

Your steps-by-steps answer would be appreciated since it would help me to understand better. Thanks.