NUMERICAL ANALYSIS OF INTERNALLY MIXED ANNULAR ATOMIZER

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ABSTRACT

The atomizers represent the core of the combustion system and their good performance plays a major role to maintain the combustion efficiency as highest as possible which is not only dependent on the injection pressure, gas to liquid ratio by mass (GLR), liquid and gas properties, its also depends on two phase flow structure and void fraction within atomizer nozzle. The main objectives of present study is visualization of Internal Two Phase Flow which may contributes or responsible to nearly constant drop size for liquid injection pressure and gas/air to liquid ratio by mass (GLR or ALR) . To accomplish this objective, a numerical modeling of the structure and dynamics of the internal mixing flow has been done. It is felt that an understanding of the basic jet atomization phenomenon gained in this way would be very helpful for the understanding of the more complicated jet disintegration process. Internally mixed annular atomizer configurations were modeled at Liquid injection pressure 207 kpa to 414 kpa and GLR 0.05.to 0.15. Three flow patterns are observed from mixing chamber to exit namely slug, churn and finally annular flow at the exit of orifice. At lower GLR, the flow pattern received at the exit of orifice in annular having void fraction is lower about 0.29 -0.5. At higher GLR the flow pattern at exit of orifice is annular having higher void fraction about 0.5-0.72. At lower liquid injection pressure, void fraction ranges from 0.23 to 0.62. As pressure increases, flow pattern is annular but flow having higher void fraction ranges from 0.42 to 0.72. Flow pattern at the exit of orifice is annular at all cases. High void fraction indicates fine atomization received at higher liquid injection pressure and higher GLR As the injection pressure and GLR increases, the velocity increases which leads to better atomization.

Keywords: Atomization, Internally mixed annular atomizer, Gas to liquid ratio by mass (GLR), liquid injection Pressure, Void fraction, Two phase flow pattern.