Influence of Ambient Pressure on Twin Fluid Atomization R&D work for high pressure entrained flow gasification

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Abstract

High pressure entrained flow gasification is a very promising technology for the conversion of low-grade fuels to a high quality syngas to be used for production of chemicals and chemical energy carriers, e.g. liquid fuels or SNG. High gasification efficiencies using liquid fuels or slurry can only be achieved through generation of a fine homogenous spray at high ambient pressure and low gas to liquid ratio (GLR). Influence of spray quality on gasification performance is demonstrated by experiments in an atmospheric Research Entrained flow GAsifier (REGA).The present work is therefore focused on the atomization of liquids at increased ambient pressure using an external mixing twin fluid nozzle, typical for entrained flow gasification. For the experimental work reported, ambient pressure is varied in the range of 2 – 16 bar using water as model fuel. Spray quality, i.e. drop size distribution and axial velocity distribution is detected by Shadow sizer and PDA-System, respectively. A high speed camera is used for qualitative investigation of primary atomization. The experiments show the influence of reactor pressure on spray quality in terms of SMD, for operational conditions at We = const. and alternatively at u_{rel} = const. Basic finding is that keeping the We-number constant is not enough to guarantee for constant atomization quality at varying reactor pressure, but the relative velocity has a dominant effect. The experimental results are discussed on the background of a short literature review.