Characteristics of the Atomization in Counter-Swirl Internal Mixing Atomizer

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To illustrate the global variation of the droplet mean diameters and the turbulent flow characteristics in counterflowing internal mixing pneumatic nozzle, the experimental measurements at five axial downstream locations(i.e., at Z=30, 50, 80, 120, and 170mm) were made using a PDPA(Phase Doppler Particle Analyzer) under the different air injection pressures ranging from 40 kPa to 120 kPa. A nozzle with axi-symmetric tangential-drilled four holes at an angle of 15° has been designed and manufactured. The distributions of velocities, turbulence intensities, turbulence kinetic energy, turbulent correlation coefficients, spray angle, droplet mean diameters, volume flux, number density are quantitatively analyzed. It is possible to discern the effects of increasing air pressure. It indicates that the strong axial momentum in spite of more or less disparity between the velocity components means more reluctant to disperse radially, and that axial fluctuating velocities are substantially higher than those of radial and tangential ones, suggesting that the disintegration process is enhanced under higher air assist. The larger droplets are detected in the spray centerline at the near stations and smaller ones are generated due to further subsequent breakup at farther axial locations are attributed to the internal mixing type nozzle characteristics. Despite of the strong axial momentum, the poor atomization around the centre close to the nozzle exit is attributed to the lower rates of spherical particles which are not subject to instantaneous breakup. As it goes downstream, however, substantial increases in SMD(Sauter Mean Diameter) from the central part toward spray periphery are understandable because the droplet relative velocity is too low to bring about any subsequent disintegration.