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Drop Characteristics of non-Newtonian Impinging Jets at High Generalized Bird-Carreau Jet Reynolds Numbers[1] PAUL E. SOJKA[2], NEIL S RODRIGUES[3], M.J. Zucrow Laboratories, Purdue University — The current study investigates the drop characteristics of three Carboxymethylcellulose (CMC) sprays produced by the impingement of two liquid jets. The three water-based solutions used in this work (0.5 wt.-% CMC-7MF, 0.8 wt.-% CMC-7MF, and 1.4 wt.-% CMC-7MF) exhibited strong shear-thinning, non-Newtonian behavior - characterized by the Bird-Carreau rheological model. A generalized Bird-Carreau jet Reynolds number was used as the primary parameter to characterize the drop size and the drop velocity, which were measured using Phase Doppler Anemometry (PDA). PDA optical configuration enabled a drop size measurement range of approximately 2.3 to 116.2 μm. 50,000 drops were measured at each test condition to ensure statistical significance. The arithmetic mean diameter (D_{10}), Sauter mean diameter (D_{32}), and mass median diameter (MMD) were used as representative diameters to characterize drop size. The mean axial drop velocity $U_{\mathrm{z-mean}}$ along with its root-mean square $U_{\mathrm{z-rms}}$ were used to characterize drop velocity. Incredibly, measurements for all three CMC liquids and reference DI water sprays seemed to follow a single curve for D_{32} and MMD drop diameters in the high generalized Bird-Carreau jet Reynolds number range considered in this work (9.21E+03 $<Re$j,gen-BC $<$2.81E+04).

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