Effect of flow-induced aggregation of ZnO suspensions in ink-jet printing

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We have investigated the drop jetting behavior of Zinc oxide (ZnO) suspensions as a model system for particulate inks. Suspension stability and dimensionless number Z, $Z=Oh^{-1}=Re/We^{1/2}$ were systematically varied over a wide range. Even if suspensions were in the appropriate range of Z, non-jetting phenomena could be occurred due to flow-induced aggregation. In order to analyze the origin of flow-induced aggregation, ring-slit device was used which flow situation is similar as nozzle inside of ink-jet printer. When aggregation takes place, the slit entrance is gradually clogged and this results in a significant increase of extrusion pressure. Not only initial dispersion condition (size and amount of aggregates) in ink properties but also entrance angle and flow rate in processing parameters are crucial factors in controlling the flow-induced aggregation. By using two types of apparatus – ink-jet printer and ring slit device – that closely resemble in flow situation, the origin of clogging and improvement of nozzle design could be discussed for particulate inks.