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Force analysis acting on the moving droplet in air-flow[1] YEWON KIM, HYUNGMIN PARK, Seoul National University, ALIDAD AMIRFAZLI, York University — Movement of a water droplet over a surface due to a shearing airflow was studied in a wind tunnel. Water droplets (5-20 μl) were placed on PET (hydrophilic) and PTFE (hydrophobic) surfaces; airflow velocities up to 25 m/s and accelerations between 4.4-10 m/s^2 were used. The Reynolds number is under 3,400 based on the free-stream air velocity (U_∞) and the height of the droplet (h). High-speed cameras from top and side views were used to evaluate the droplet velocity, acceleration, and contact angle hysteresis. Droplets start to move at different air velocities depending on the droplet volume, flow acceleration, and surface wettability. Also, droplets show different acceleration pattern for different experimental case. For example, when flow acceleration is 4.4 m/s^2, 5μl droplet on the PTFE surface start to move at lower free-stream velocity with lower droplet acceleration compared to those on the PET surface. To understand the behavior of droplets, we constructed a model by considering the drag, adhesion, and viscous forces acting on the moving droplet. We would discuss the relation between the droplet behavior and airflow state (velocity and acceleration) and validate our force balance model for the droplet.

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