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Non-clogging Coulter Counting with Electrohydrodynamic Jets
YUEJUN ZHAO, CHUAN-HUA CHEN, Duke University — Coulter counting (resistive pulse sensing) is the standard technique for quantifying biological cells and colloidal particles. The solid-state sensing aperture in conventional Coulter counting is expensive and prone to clogging. Here, we report a new paradigm of Coulter counting using an electrohydrodynamic liquid jet as the sensing "aperture." The stable electrohydrodynamic jets were produced between double cones at conditions similar to the well-known cone-jet mode, but at a much higher electric field previously thought to only produce unstable jets. Micron-sized particles were successfully detected through resistive pulse sensing in the liquid jet. Similar to conventional Coulter counting, the relative current change was proportional to the particle-to-jet volume ratio. However, the liquid sensing aperture can deform and accommodate impurities and agglomerates much larger than the aperture (jet) diameter, and therefore has a major advantage of being non-clogging.

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