# Understanding unexpected charging processes of singlet and doublet microparticles in a low-pressure spatiotemporal afterglow plasma

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With the ever decreasing size of computer chips, maintaining a high level of cleanliness in the manufacturing equipment becomes increasingly crucial. To eradicate any contaminating particles in the governing ultra-clean low-pressure systems (J. Beckers et al. 2023), the concept of a so-called "plasma seal" has been introduced, where a plasma is used to charge the particles which then can be deflected using an externally applied electric field. Since the plasma inherently shields externally electric fields, this deflection must occur at a distance from the plasma or shortly after termination of the plasma, or a combination of both: the spatiotemporal afterglow. Over the recent years, research has been conducted by van Huijstee et al. (2023) to understand the fundamental principles of particle charging mechanisms and how these are affected by spatiotemporal afterglow conditions. To bridge the gap between this fundamentally oriented research and its potential application, ongoing research aims to investigate the effect of particle properties such as dielectric constant and size. To study the effect of the dielectric constant, the charge of microparticles made of melamine formaldehyde (MF) coated with silver (conductors) and $SiO_2$ (insulators) are investigated and compared. To explore the impact of particle size and shape, the charge variation is measured for single particles (singlets) and clusters of two particles (doublets). In addition, the experiments uncovered an unexpected factor influencing the equilibrium charge of the particles is the particle injection method which conventionally is achieved through shaking a device akin to a salt shaker. It turned out that after a certain number of shakes, the average residual charge of the particles undergoes an abrupt shift from negative (-400 $e^-$) to positive (+500 $e^-$). Possible explanations for this behavior will be discussed in this contribution.

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