Order of magnitude for different time scales

Hydrodynamic time scale $\sim 10^{-3}$ to 10^{-4} s

Viscous diffusion time scale $\sim 10^{-3}$ s

Charge diffusion time scale $\sim 10^{-5}$ to 10^{-7} s

Charge diffusion time scale is the shortest $\Rightarrow$ Sufficient time to charge the polarized layer on the liquid side of the meniscus interface when the jet is moving out of the capillary.

Elastic relaxation time scale of polymeric liquid $\sim 10^{-2}$ s.

However, for AC electrospray, the additional time scale is the AC time period

$$= \frac{1}{\text{AC frequency in Hz}}$$

During AC electrospray, the polarity of the cone-jet oscillates with every half-cycle of applied frequency to produce positive and negative cone-jet.

Before the polarity reverses, the fluid must reach the tip (Hydrodynamic and viscous time scale), polarized layer must develop on the liquid side of the meniscus (Charge diffusion time scale), and elastic relaxation for polymeric liquid must have completed (Elastic relaxation time scale). Otherwise, it would be mere elastic stretching, and/or a minor protrusion at the tip moving in and out at every polarity reversal instead of stable cone-jet formation.

$\Rightarrow$ For AC electrospray, AC time scale should be the longest.

For 50 Hz, the time scale $\sim \frac{1}{50} \sim 10^{-2}$ s