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Electrokinetic lift ORY SCHNITZER, EHUD YARIV, ITZCHAK FRANKEL, Technion — Electrolyte flow relative to a charged surface induces a bulk electric field (the "streaming potential" phenomena). This field, and the flow perturbation it animates, generate both electrical and hydrodynamic "electro-viscous" forces whose magnitude has been a matter of ongoing controversy. Recently we have revisited this problem, predicting $O(\delta^2)$ scaling (as opposed to earlier prediction of δ^4 and δ^6), $\delta \ll 1$ being the dimensionless Debye width. These electro-viscous forces can explain the anomalous repulsion of polystyrene microspheres from an adjacent wall in the presence of an imposed shear flow, observed by Prieve and co-workers. Owing to the symmetry properties of the linear Stokes equations, such repulsion is inadmissible in the absence of inertial effects. This particle–wall interaction is analyzed using our revised scheme. The undisturbed flow consists of three components: the 'driving' shear mechanism and the 'induced' particle translation and rotation. We consider a small dimensionless particle–wall gap ϵ. At leading-order, both the lift and additional drag are contributed by the inner gap region. The lift force is $O(\delta^2\epsilon^{-3})$ while the additional drag is $O(\delta^2\epsilon^{-2})$. The streaming-potential mechanism underlying these forces arises from the 'induced' rather than the driving component.

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