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Electro-convection about conducting particles in the thick-Debye-layer limit EHUD YARIV, MOHAMMAD ABU HAMED, Technion — In recent years there is an increasing interest in electrokinetic flows about polarizable bodies and particles, where the thin-Debye-layer model is commonly employed. This model may fail for nano-size particles, where the Debye layer thickness may be comparable to the particle dimension. Using a weak-field approximation, we here analyze the limit of a thick Debye layer. We consider the simplest scenario: steady-state electrokinetic flow about an initially uncharged conducting sphere. The dimensionless problem is governed by two parameters: β, the applied field magnitude (normalized with the thermal scale), and λ, the Debye thickness (normalized with the cylinder radius). The double limit $\beta \ll 1$ and $\lambda \gg 1$ is singular: standard asymptotic expansions fail to satisfy the far-field velocity decay condition. The resolution of the flow field requires use of inner-outer asymptotic expansions. Two distinguished limits are discussed: the thick-layer limit $1 \ll \lambda \ll 1/\beta$, in which the outer domain is characterized by the Debye thickness, and the "super thick" limit $1 \ll 1/\beta \ll \lambda$, in which the $O(1/\beta)$ outer domain reflects a transition form diffusionally-governed ionic concentrations to a dominant balance between diffusion and electro-migration.

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