

Exploring the Mineral-Water Interface of Individual Hematite Nanoparticles by Particle-Impact Chronoamperometry

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Hematite, α -Fe₂O₃, is one of the most abundant and thermodynamically stable iron oxide minerals in Earth's upper crust. Nano-scaled hematite plays an important role in natural and technological settings as it is a source of bioavailable iron, an adsorbent of various groundwater/air pollutants, and a promising electrocatalyst for a renewable energy devices. In these respect, uncovering the intrinsic physicochemical properties of hematite nanoparticles is of great interest.

Particle-impact chronoamperometry is a recently established electrochemical characterization technique for *individual* nanoparticles suspended in a supporting solution. This technique makes use of the random Brownian motion of nanoparticles resulting in collision with a stationary microelectrode. At appropriate electrode potential, electron transfer between a particle and an electrode takes place upon impact and generates a spike in a chronoamperogram.¹ This technique has been applied to study electrochemical properties of various nanoparticles of anthropogenic[1] and natural[2,3] origins.

Particle-impact analysis reveals that individual hematite nanoparticles are much more reducible with much smaller overpotential than the agglomerate due to the efficient diffusion of protons to the particle/water interface. Further investigation shows that this technique can complement the nanoparticle tracking analysis to address pH and size dependent colloidal stability by tracking the number of non-clustered mineral nanoparticles.

[1] N. V. Rees, Y. Zhou and R. G. Compton, *RSC Adv.*, 2012, **2**, 379–384. [2] K. Tschulik, B. Haddou, D. Omanović, N. V. Rees and R. G. Compton, *Nano Res.*, 2013, **6**, 836–841. [3] K. Shimizu, K. Tschulik and R. G. Compton, *Chem. Sci.*, 2016, **7**, 1408–1414.