

Richard G. Finke, Colorado State University
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Abstract

“Transition-Metal Nanoclusters: From Solution Synthesis, Stabilization and Mechanism of Formation to Supported Nanoparticle Heterogeneous Catalysts”

Following a brief introduction to nanoclusters, nanocatalysis and a reminder about Platt et al.’s preferred scientific method of verification or refutation (namely the attempted disproof of all possible alternative hypotheses; “for exploring the unknown, there is no faster method”), the talk will examine 4 main areas: (i) the synthesis, characterization and stabilization mechanisms of prototype, high stability polyoxoanion-stabilized Ir(0)₋₃₀₀ nanoparticles; (ii) evidence for a 2-step minimal (“Ockham’s Razor”) mechanism of formation for those Ir(0)₋₃₀₀ nanoparticles—a kinetically and mechanistically best understood example at present; (iii) more on the 2-step mechanism, including its significance, additional applications (including solid-state reactions, organometallic catalyst formation and protein aggregate formation in neurological diseases), as well as the strengths and limitations of the minimalistic 2-step mechanism; and (iv) the discovery of the apparently more general, 4-step mechanism by which nanoparticle catalysts—and probably other nanoparticles in nature—form and agglomerate (aggregate). The talk will also briefly cite recent work on extending the nanoparticle synthetic and mechanistic studies to “supported-nanoparticle heterogeneous catalyst formation *in contact with solution*: Ir(1,5-COD)Cl/ γ -Al₂O₃ and its reduction to Ir(0)₋₉₀₀/ γ -Al₂O₃”. The talk will then conclude with a few Summary and Conclusions slides.