Tailoring magnetic properties of nanoparticles by gas-diffusion electrocrystallization (GDEx)

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Abstract

Gas-diffusion electrocrystallization (GDEx), a new electrochemical process that we have developed, yieds colloidal dispersions or solid nanoparticles with well controlled and narrowly distributed properties[1]. The general principles and mechanism through which GDEx operates will be introduced. Examples of nanomaterials we have achieved and their functionality and industrial relevance will be disclosed. GDEx produces finely-tuned compositions of magnetite (Fe_3O_4) nanoparticles in the range of 20 to 100 nm, providing the possibility to regulate magnetic susceptibility as MRI contrast agent and for hyperthermia treatment. Solid nanoparticles of herbertsmithite ($ZnCu_3(OH)_6Cl_2$) with liquid-like magnetic spin have also been obtained. These Cu/Zn-based nanoparticles may have applications in data storage. GDEx is revealed as a new, flexible route to synthesize a wide range of nanoparticles with versatile control of composition, morphology, and physicochemical parameters such as crystallite size, lattice parameter, particle size, which in turn tailor specific functionalities.

References

(1) Dominguez Benetton, X.; Alvarez Gallego, Y.; Porto-Carrero, C.; Gijbels, K.; Rajamani, S. An Electrochemical Process for Preparing a Compound Comprising a Metal or Metalloid and a Peroxide, Ionic or Radical Species. Patent US20180023201A1.

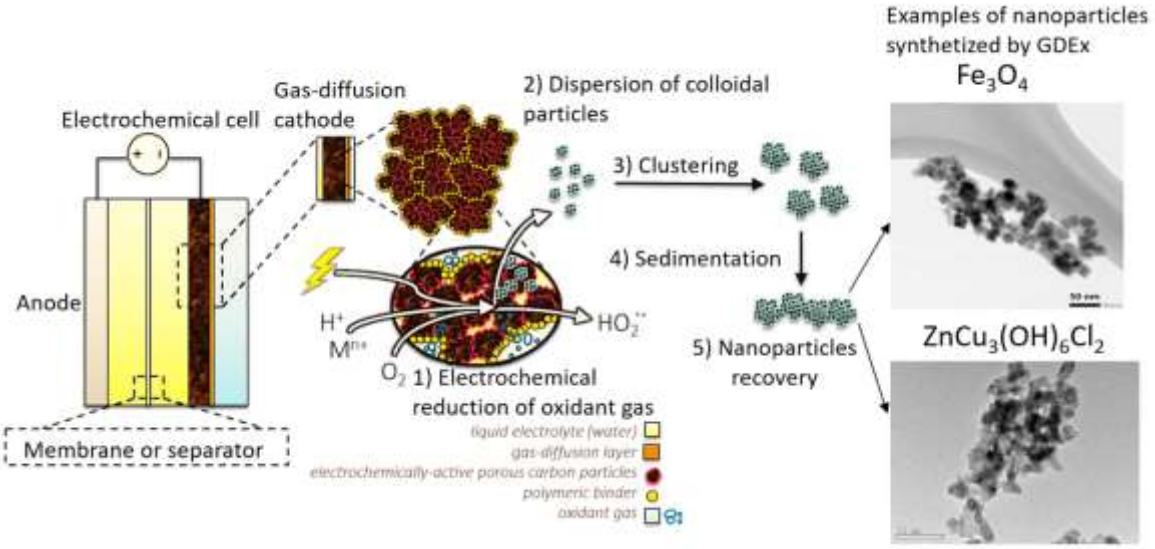

Figure 1. Gas diffusion electrocrystallization concept for the synthesis of magnetic nanoparticles.[1]

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