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Synthesis of (doped) ABO_2 nanoparticles: Can this work at temperatures ≤90°C without using an additional reducing agent?

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Delafossite (ABO_2) is in focus of extensive research for its special magnetic, photo- and electrochemical as well as antiviral properties. Delafossite structures shows a wide variability of chemistry (A=e.g. Cu, Ag and B=e.g. Fe, Mn, Cr, Co, Al) and are used for diverse technical applications including catalysis, p-type conduction oxide, solar cells, or as luminescent material. Many physical properties are directly related to grain size, but most of the common synthesis routes as solid-state reactions, sol-gel or hydrothermal techniques lead to crystals in micron size. With the Lt-delafossite process, a new synthesis route by precipitation and subsequent ageing, it is possible to gain pure nano-sized delafossite at temperatures ≤90°C. The synthesized product exclusively consists of hexagonal, platy crystals with a diameter of less than 500 nm. The thickness increases with increasing ageing time from 5 to 200 nm. In case of $CuFeO_2$, green rust (GR), precipitates first. Additional supply of OH- leads to the transformation of GR to delafossite. At the same time, GR acts as reducing agent for Cu^{2+}. The ratio of 3R and 2H polytype is directly controllable by NaOH supply. The magnetic properties of $CuFeO_2$ prepared by Lt-delafossite process deviate from both, natural delafossite and samples synthesized by other routes. A new approach is to produce doped delafossite. However, the incorporation of foreign ions is limited. Partly, they are adsorbed on the surface and so hinder crystal growth especially in [001]. Moreover it promotes twinning of the crystals.

Biography

Melanie John completed her BSc in Earth Sciences in 2012. She continued her studies in Geomaterials and completed her MSc in 2014. Within two years, she completed her PhD studies. She developed an environmental sustainable concept to extract heavy metals from aqueous solutions. At the same time, she created a new method to synthesize nanoparticles as delafossite and special core-shell composite materials at low temperatures <90°C. Now, she is continuing to widen her interdisciplinary research field. She published papers in reputed journals.

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