Nano- to microstructured cobalt orthovanadate BaCo3(VO4)2(OH)2: new synthesis routes, structural and magnetic properties

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Résumé

3d transition metal ions-based vanadates materials with layered crystal structures have triggered strong interest because of their various potential applications. For instance, nanostructured materials are promising candidates for photocatalysis (1), while crystalline microparticles are needed to study low-dimensional magnetism (2). The crystal structure of BaCo3(VO4)2(OH)2 was resolved for the first time using small single crystals obtained by Dordevic et al. (3), and it can be described as brucite-like kagome sheets of Co3(OH)8 capped by VO4 tetrahedra and stacked along the c-axis. However, their physical or chemical properties were not investigated because no reported synthesis route was able to produce phase-pure BaCo3(VO4)2(OH)2.
Recently, phase-pure quasi-spherical nanoparticles with sizes in the range of 9-25 nm were obtained for the first time via a new synthetic route at ambient pressure (4). Rietveld refinement of XRD patterns, vibrational spectroscopies, and high-resolution scanning transmission electron microscopy (HR-STEM) indicated that the rhombohedral crystal structure is not affected by nanostructuring. Magnetization measurements were consistent with high-spin Co2+ ions for which unquenched orbital angular momentum is present. Based on these results, we report another route for the synthesis of phase-pure micrometric-sized crystalline BaCo3(VO4)2(OH)2 which will allow a better understanding of the magnetic properties and particle-size effects (5). The results of our structural and physicochemical characterizations will be presented.
References:

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