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Synthesis via hydrothermal route, morphology control, and luminescent properties of rare-earth doped $GdPO_4$ particles

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Development and improvement of nano- and micro- sized particles and structures has caught focus of scientists in recent years. Rare-earth doped –nano and –micro orthophosphate particles are promising materials for their chemical and thermal stability, luminescence properties, and low toxicity. They have wide field of applications such as luminescent phosphors, electronics, drug delivery, down/up-conversion materials, catalysis and bio-applications[1-3].Controllable size and morphology is important aspect of this research area, responsible for unique luminescent and physical properties including density, specific area, solubility, stability, reactivity, and zeta-potential of sintered particles. Synthesis of various $LnPO_4$ particles has been studied extensively recently and various morphologies such as nanorods, nanowires, nanofibers, nanocubes, microspheres are reported. Yet, effectiveness in synthesis of $LnPO_4$ particles with an aim to obtain desired morphology, narrow size distribution, good dispersibility in various solvents is still to be improved[4,5]. Herein, we report hydrothermal synthesis route of $GdPO_4$ particles assisted by tartaric acid as a coordinating agent. Several different morphologies such as nanofiber, nanorods, nanoprisms, microspheres were synthesized. Obtained particles are uniform, well-shaped and comparatively small-sized (see Fig. 1). Dispersions of $GdPO_4$ samples remained stable for months. Some properties of sintered particles and the impact of synthesis conditions upon particle phase and morphology were investigated and is discussed in this work. Recently, particles were doped with Nd^{3+}, Dy^{3+}, Yb/Er ions. Investigation of PL properties is ongoing.

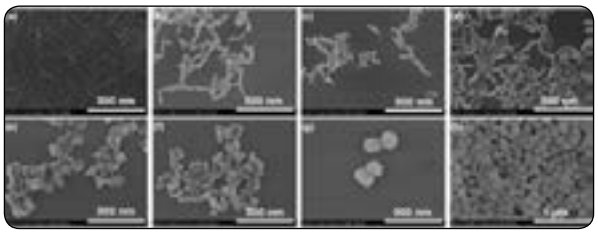

Fig. 1. SEM images of GdPO4 particles. Images represent NH4H2PO4/Gd3+ molar ratio impact upon particle morphology: (a) 1, (b) 4, (c) 7, (d) 10, (e) 20, (f) 50, (g) 75 and (h) 100 respectively.

Recent Publications:

1. W. Di, M. G. Willinger, R. Ferreira, X. Ren, S. Lu, N. Pinna, J. Phys. Chem. C (2008), 112, 18815-18820.
2. A. Garrido Hernández, D. Boyer, A. Potdevin, G. Chadeyron, A. Garcia Murillo, F. de J. Carrillo Romo, R. Mahiou, Phys. Status Solidi A (2014) 211, No. 2, 498-503.
3. J. Yang, J. Cao, D. Shen, J. Xiong, J. Tang, S. Hu, CrystEngComm (2016) 18, 8944.
4. S. Ray, G.B. Nair, P. Tadge, N. Malvia, V. Rajput, V. Chopra, S.J. Dhoble, Journal of Luminescence (2018), 194, 64-71.
5. Z. Wang, X. Shi, X. Wang, Q. Zhu, B. Kim, X. Sun, J. Li, CrystEngComm (2018), 20, 796-806.

Biography

Matas Janulevicius has his expertise in both hydrothermal and solid-state synthesis of luminescent materials. He has experience in developing silicate, molybdate and phosphate based materials doped with rare-earth ions. He developed his skills after years of experience in research, synthesis and investigation of luminescent properties of materials in Vilnius University, Lithuania, as well as during his internships in Hasselt (Belgium) and Tartu (Estonia) universities. Matas Janulevicius has published several articles based on his sintered materials. He also has expertise in organic synthesis of luminescent compounds and is co-author of paper which investigates PL properties of his sintered naphtoquinoline based luminescent compounds.

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