UNIVERSITI TEKNOLOGI MARA

PREPARATION AND CHARACTERIZATION OF LANTHANUM PHOSPHATE NANOSPARTICLES BY SOLGEL SPIN COATING METHOD

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The sol-gel method was used to prepare $LaPO_4$ nanoparticles as the intimate mixing of the chemical in ensuring homogeneity of the product. Besides, sol-gel methods also have much compensation compared to other methods such as easy coating of large surfaces, low processing temperature and also simple and cheap experiment set-ups. In this work, a sol-gel spin coating method was adopted to prepare $LaPO_4$ nanoparticles with good morphologies. $NH_4H_2PO_4$ and $La(NO_3)_3.6H_2O$ were used as a precursor or starting material. $C_{10}H_{16}N_2O_8$ (EDTA) and $C_6H_8O_7$ were used as the chelating agent in the starting solution, while NH_3 solution was used as a solvent. $LaPO_4$ nanoparticles have been successfully prepared with different concentrations, 0.01, 0.03, 0.05, 0.08 and 0.10 mol of EDTA under constant calcinations temperature, 500°C. The morphology of $LaPO_4$ nanostructures deposited on glass substrate shows nano-rice, nano-sphere, and nano-particle structures. A size of sphere-like structures is smallest at concentration of EDTA 0.05 molar. The intensity of photoluminescence was found to be increased as the concentration of EDTA increased, and $LaPO_4$ prepared at 0.05 mol concentration of EDTA has higher intensity. This is due to highest intensity of PO_4^{3-} bonding existed. Next, the calcinations temperature to produce thin film $LaPO_4$ nanostructure was varied at; 200, 300, 400, and 500°C. FESEM results show that at lower annealing temperatures, 200°C and 300°C, the rice-like structures of $LaPO_4$ was formed and when the temperatures were increased to 400°C and 500°C, the $LaPO_4$ started to form a spherical shape. The intensity of photoluminescence was found to be decreased as the calcinations temperature increased and 400°C showed higher intensity compare to others. The peak shifted to the left for calcinations temperature 400°C and the shifting of the peak to the right at 500°C.Using the same sample preparation condition of 0.05 molar concentration of EDTA and 400°C calcinations temperature, the number of $LaPO_4$ coating layer were varied to 1, 3 and 5. Different coating on the glass will contribute to the different sizes and morphologies of the $LaPO_4$ nanostructures thin film. With increasing number of layers, the particles appear to stick together and this increases the density of nanoparticles formed on surface. The intensity of photoluminescence was found to be decreased as the number of layers increased and 1 layer showed the higher intensity. When the number of layers increased, the peak was shifted to the left and photon emission energy recorded was increased.

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