J Material Sci Eng 2012, 1:3
http://dx.doi.org/10.4172/2169-0022.S1.008

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International Conference and Expo on
Materials Science & Engineering

October 22-24, 2012 DoubleTree by Hilton Chicago-North Shore, USA

Effect of alkali ions doping toward tuning the structure and upconversion emission of monodispersed $NaYF_4$

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Studies on upconversion (UC) phosphors have grown rapidly owing their wide applications in solid state lasers, three dimensional flat displays, to enhance the efficiency of silicon solar cell, and their use in biomedical sciences. UC refers to nonlinear optical processes in which the sequential absorption of two or more photons leads to the emission of light at shorter wavelength than the excitation wavelength (anti-Stokes emission). The most efficient UC mechanisms are present in solid-state materials doped with rare-earth ions. The development of nanocrystal research has evoked increasing interest in synthesis routes which allows highly efficient, small UC particles with narrow size distribution. Herein, we present effect of alkali ion substitution into $NaYF_4$:Yb,Er nanocrystals on the crystal structure and subsequently the upconversion emission spectra were studied. Substitution of Li and K favors the formation of Hexagonal phase of $NaYF_4$. Understanding the phase transformation of $NaYF_4$ nanocrystals from cubic to hexagonal is of great importance for both scientific interests and applications. Furthermore, the intensity ratios between the blue, green, and red emission peaks changed accordingly, and make it possible to tune the upconversion fluorescence of the nanocrystals by Li and K doping. The alkali ion substitution has been found to have remarkable effect on the performance of some of the rare earth phosphors. Therefore, the effect of alkali ion on the $NaYF_4$: Yb,Er phosphor were studied to improve and tune the emission of the phosphors. Particularly, attention was given to the effect of the alkali ion of K^+ to improve the luminescence efficiency of the phosphor. Our results suggest that the substitution of alkali ions efficiently promotes the phase transformation of $NaYF_4$ nanocrystals and provide new insight into how the alkali ion affects the phase transformation of nanocrystals.

Biography

Abhay has completed his Ph.D in Physics from NEERI (Nagpur University) and postdoctoral studies National Physical Laboratory and Indian Institute of Science. He is the Research Scientist in IIT Bombay, a premier research and education organization. He has published more than 10 papers in reputed journals and proceeding and reviewer of journals of repute.

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Hydrogen separation and purification using composite inorganic membranes

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The main purpose of this work is to prepare a composite palladium membrane on ceramic alumina support by using the electroless plating method and to compare the hydrogen separation and purification performance of this membrane with that of an uncoated ceramic alumina support. The work involves fabrication of membrane using ceramic materials. In the study, a hydrazine based plating method was used to prepare a palladium membrane on alumina support in a modified electroless plating method and tested for hydrogen permeation. The permeance of hydrogen was investigated across both the Pd membrane and the commercial alumina membrane. The permeation of a gas mixture (H2 = 50%, CO = 28%, CO2 = 10%, CH4 = 8%, and N2 = 4%) was tested across the Pd membrane. In comparison, the results indicate a much higher performance in terms of hydrogen separation and purification. The results for commercial alumina membrane also show that the order of permeance of the gases do not follow the order of their kinetic diameter while the Pd membrane show a higher permeance for hydrogen compared to the gas mixture. This could be attributed to transport of the heavier components of the gas mixture. These results indicate a marked improvement in hydrogen separation and purification performance of Pd membranes prepared by electroless plating for high purity hydrogen especially for fuel cell applications.

Biography

Abubakar Alkali is currently a PhD student at Robert Gordon University Aberdeen U.K and is working on Hydrogen separation and purification processes using inorganic composite membranes with particular emphasis on palladium and its alloys. He is also working on catalytic hydrogenation and dehydrogenation reactions using composite palladium membranes in a membrane reactor. His work involves the application of several methods of fabrication of these membranes but with emphasis on Electroless plating technique. Mr Alkali's other research interests include photocatalytic methods for the production of hydrogen from renewable sources. He has attended the International hydrogen research showcase (U.K) in April 2011 where he made a presentation.

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