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Deep UV Reversible Optical Data Storage Properties of Alkaline Earth Matlockites Doped with Samarium Ions in the Trivalent Oxidation State

Lubina Thattamveedu Kasim[1]*, Nicolas Riesen[2,3], Kate Badek[1] and **Hans Riesen[1]**
[1]The University of New South Wales, Australia
[2]The University of South Australia, Australia
[3]The University of Adelaide, Australia

In the past decades, the unique properties of rare earth elements have played an important role in a wide range of technologies based on luminescence. Inorganic nanocrystalline alkaline earth fluoro halides (MeFX: Sm^{3+}; Me = Ba, Sr; X = Cl, Br, I) crystallize in P4/nmm-D4h space group and upon exposure to UV-C light exhibit an extraordinary photoreduction mechanism. We believe that the presence of oxide impurities such as ($O2^{2-}$, $O2^{-}$) facilitates the valence state switching from Sm^{3+} to Sm^{2+} with remarkably high efficiency upon excitation into absorption bands in the deep ultra-violet region centred around 200 nm. The generated Sm^{2+} increases in a linear fashion with increasing UV-C exposure. To investigate the reversibility of the valence state switching, the photoionization mechanism of Sm^{2+} was studied via photoluminescence. The bleaching kinetics indicate that the average separation between the samarium ions and the oxide impurities is on the order of a few interionic spacing. The photoionization process was modelled by employing dispersive first order kinetics. The samples of samarium doped MeFX were prepared by ball milling and characterized by different spectroscopic techniques. The average isotropic crystallite size is ~30 nm. This study yields new insights into ultra-high density multilevel optical data storage in the frequency domain with the possibility to burn multiple holes to yield higher data storage density at room temperature.

Biography:

Lubina Thattamveedu Kasim has received her Master's in five year Photonics course from International School of Photonics, Cochin University of Science and Technology in 2014, India. She carried out various research projects in the area of Nanophotonics and Laser spectroscopy during the past few years. Lubina is currently a PhD student in Physics at University of New South Wales, Canberra, Australia since 2015. Her current research aimed to develop a UV optical storage medium to enhance the current optical data storage capacity by studying properties of rare earth ion doped nanoparticles. She has attended five conferences and published four conference papers as well as Co-author in Journal publication.