Lumdetr 2009

7th International Conference on Luminescent Detectors and Transformers of Ionizing Radiation

LUMDETR 2009

12-17 July 2009, Kraków, Poland

BOOK OF ABSTRACTS

Organized by
The Henryk Niewodniczański Institute of Nuclear Physics
Polish Academy of Sciences

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LUMINESCENCE BEHAVIOUR OF $CuAl_6(PO_4)_4(OH)_8 \cdot 4H_2O$

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We, herein, study the thermoluminescence (TL) and cathodoluminescence (CL-SEM) emissions of a commercial turquoise [$CuAl_6(PO_4)_4(OH)_8 \cdot 4H_2O$] to obtain its luminescent features. The widespread use of this material in jewellery makes it interesting to determine its possible use as an emergency dosimeter. CL spectrum of bulk sample displays an intense broad emission from ~260 to ~650 nm together with a weaker narrow band at ~710 nm. Through EDS and EMPA chemical analyses, an important amount of rare earth elements (REE) such as Ce, La, Y, Nd, Dy, Yb, Er, Pr, Sm, Gd, Ho, Tb, and Tm have been identified in the phosphate phases. Apatite [$Ca_5[OH(PO_4)_3]$], monazite [$(Ce,La,Nd,Th)PO_4$], and xenotime [YPO_4] have been detected in the turquoise matrix, as well as very small amounts of quartz [SiO_2]. Turquoise itself has a high content in Zn substituting for Cu, together with small amounts of Cr substituting for Al. The well defined peak observed at ~710 nm can be due to Cr^{3+} activation centers in the Turquoise lattice. The broad emission is probably associated with a big variety of REE activators. Regarding the blue TL, two emission bands (190° and 330°C) appear in the natural aliquot whereas the irradiated sample displays no response at all. As observed in other natural materials, this glow emission could be due to (i) structural defects, (ii) consecutive breaking linking bonds (e.g. Al-O, Cr-O, etc.) from the lattice of the different phosphates induced during the TL readout and (iii) the losses of structural water molecules in the turquoise lattice.