Characterisation of the thermoluminescent properties of a phosphor material for deployment as an optical temperature measurement technique

Mr. Lucas Erasmus

It is generally known that the energy to light conversion efficiency of some inorganic phosphor materials is temperature dependent and therefore gives these phosphor materials their temperature sensing characteristics. Phosphor materials that exhibit this characteristic are known as thermographic phosphors. A generic phosphor thermometry system consists of an excitation source that is used to excite the phosphor material that is bonded to the surface of interest (Figure 4). The emission of the phosphor material is then analysed and compared to pre-calibrated (Figure 2) and mathematically manipulated data (Figure 3) to determine the temperature of the surface in question. This study is focused on the investigation and measurement of optical thermometry properties of Lanthanum Oxysulphide doped with Europium (La_2O_2S:Eu) by utilising and modifying a Photoluminescence system (Figure 1).

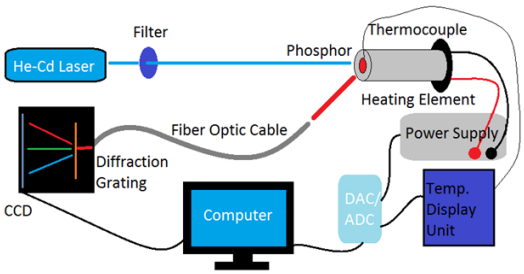

Figure 1: Experimental setup for analysing the temperature dependent fluorescence intensity

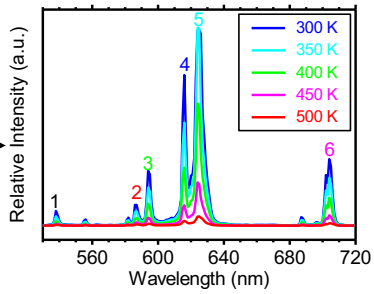

Figure 2: Emission spectra of La_2O_2S:Eu at 325 nm wavelength excitation at 300 K, 350 K, 400 K, 450 K and 500 K

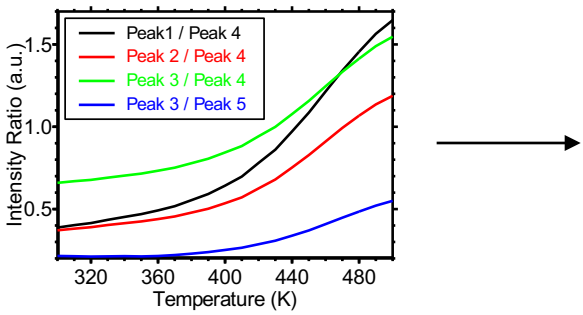

Figure 3: Intensity ratios between peaks as a function of temperature

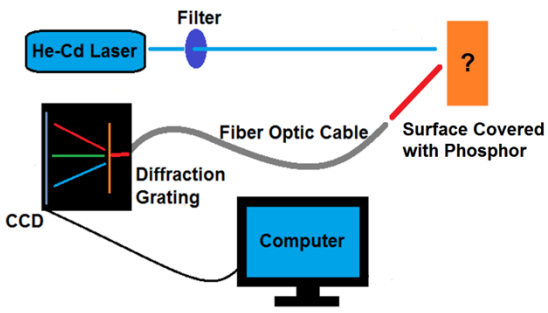

Figure 4: Determination of the temperature of the surface of interest