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# The impurity levels of lanthanide ions in silica

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<p>Silica is a basic material of technological importance for optics, microelectronics, photonics and fibre optics. Its high absorption edge energy makes its particularly useful for UV applications and it has been used as a host material for a variety of luminescent lanthanide ions due to its chemical stability and non-hygroscopic nature. For lanthanide ions the 4f electron energy levels are shielded from the host environment by the filled outer 5s and 5p orbitals, so that the transitions between these states and therefore the luminescent wavelengths are relatively insensitive to the host. For this reason little attention has been paid until recently to the location of the impurity levels of the lanthanide ions within the energy gaps of their hosts. However, luminescence from some lanthanide ions, e.g. cerium, occurs due to f-d transitions from the unshielded 5d state of which the energy relative to the f-states is therefore host dependent. The absolute positions of the 4f and 5d states relative to the energy gap of the host also affect quenching and charge trapping phenomena and so they are required for proper modeling of phosphor performance. Recently Dorenbos has suggested that the energy levels of any of the 13 divalent lanthanides relative to the band edges of the host can be found using only three parameters. However, obtaining this data for a particular host is not always straightforward e.g. use can be made of the f-d transition energy of cerium, but different values for this parameter in silica have been reported. In this paper a scheme for the energy levels of both the divalent and trivalent lanthanide ions in silica is proposed and compared to the experimental data.

## Level (Hons, MSc, <br>   PhD, other)?

other

## Consider for a student <br>   award (Yes / No)?

No

## Would you like to <br> submit a short paper <br> for the Conference <br> Proceedings (Yes / No)?

Yes

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