Luminescence of colour centres in diamond

Master/ doctoral project

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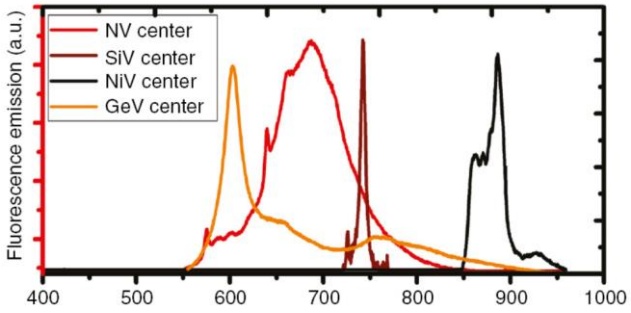
Due to the very broad band gap, the optical properties of diamond in the VIS and NIR spectral region are determined primarily by the presence of impurities and defects that form optically active centres known as colour centres. Most of the defects form deep centres in the diamond, which can be in different charge states with different optical transitions. There are currently about 500 different colour centres known in diamond, whose luminescence covers a spectral range from the ultraviolet to the near-infrared region of the spectrum. These include, for example, centres containing N, Ni, Si, Ge, Sn and Cr. [1,2]



Currently, the luminescence of colour centres in diamond is being investigated mainly for potential use in solid-state light sources, particularly single photon sources, and in the case of nanodiamonds, fluorescent tags for imaging living tissue. For these applications, high efficiency and intensity of photoluminescence at room temperature, spectrally narrow emission, short excited-state lifetime, and high photostability of the centers are desirable. The study of the photoluminescence process of these centers is a separate chapter.

There are other specific issues within this topic that have not yet been fully resolved or answered, such as reproducible fabrication of color centers, tuning the luminescence properties of color centers for a given application, and understanding the mechanisms responsible for the observed behavior.

References

[1] N. Nunn, M.D. Torelli, A. Ajoy, A.I. Smirnov, O. Shenderova, Beauty beyond the Eye: Color Centers in Diamond Particles for Imaging and Quantum Sensing Applications, Rev. and Adv. in Chem. 12 (2022) 1–21. https://doi.org/10.1134/S2634827622010044.

[2] A.M. Zaitsev, Optical Properties of Diamond, Springer Berlin Heidelberg, Berlin, Heidelberg, 2001. http://link.springer.com/10.1007/978-3-662-04548-0 (accessed September 29, 2015).