Luminescence of Pr^{3+} Containing Phosphors - Fundamentals and Applications

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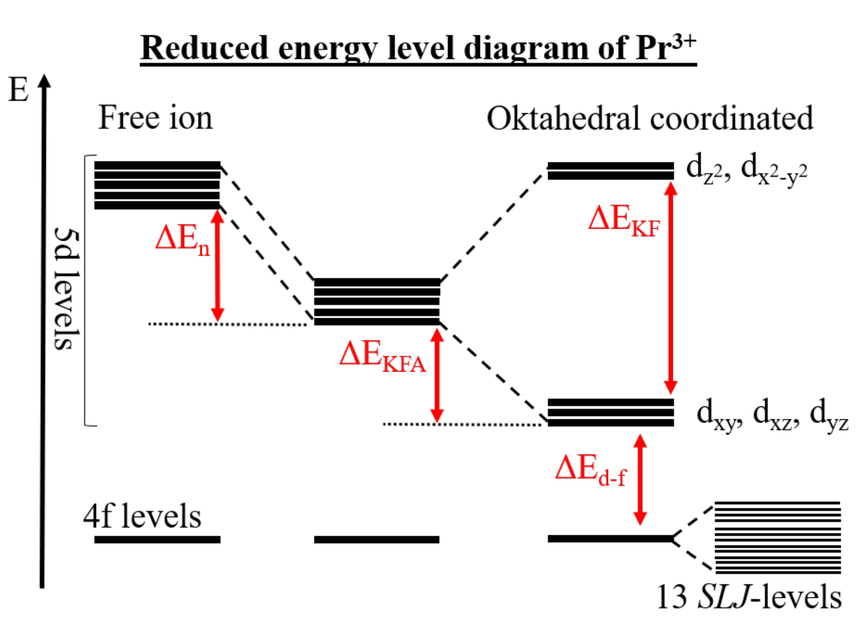
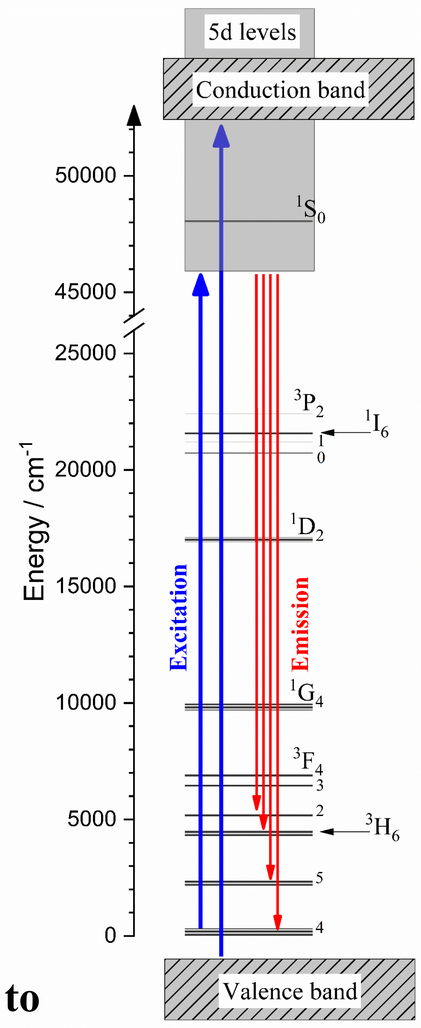
Pr^{3+} luminescence

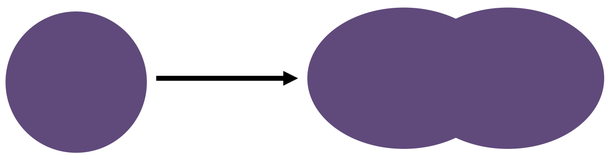
- **Due to the possibility of interconfigurational transitions between the 5d and the 4f levels, Pr^{3+} allows to achieve phosphors with quite versatile emission behaviour.**
- **The position of the $[Xe]4f^2 \leftrightarrow [Xe]4f^15d^1$ absorption and emission features depends on the energetic distance between the involved energy levels.**
- **The energetic position of the 4f levels can be considered almost unchangeable, whereby the position of the 5d levels strongly depends on the interaction between the Pr^{3+} and the host material.**

Reduced energy level diagram of Pr^{3+}



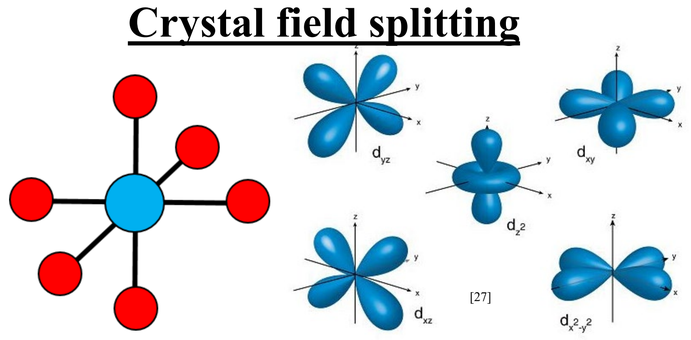


Nephelauxetic effect



Reduction of the repulsive interaction between the 5d electrons of the central ion by expanding the "electron cloud" due to involved ligand orbitals.

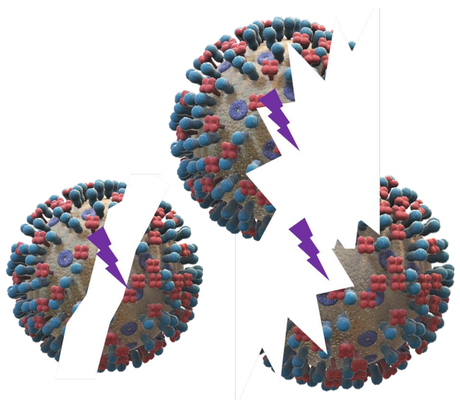
Crystal field splitting

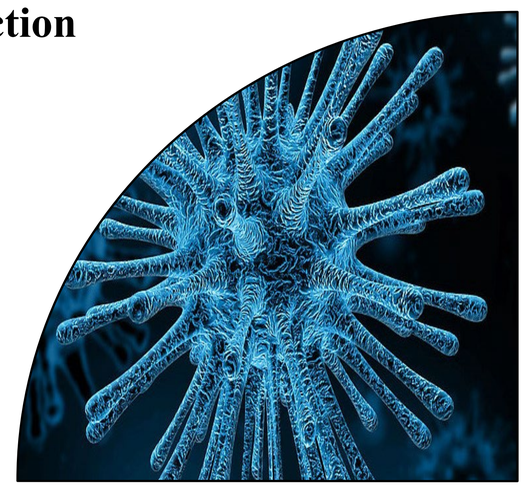


Geometry dependent splitting of the 5d levels, due to the interaction with ligand orbitals.

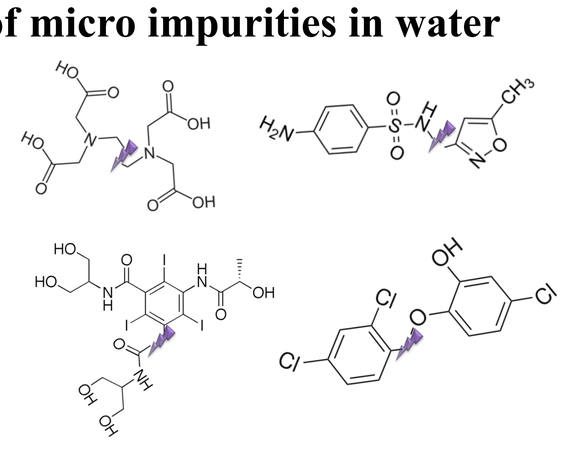
Application Areas

Water, air, and surface disinfection

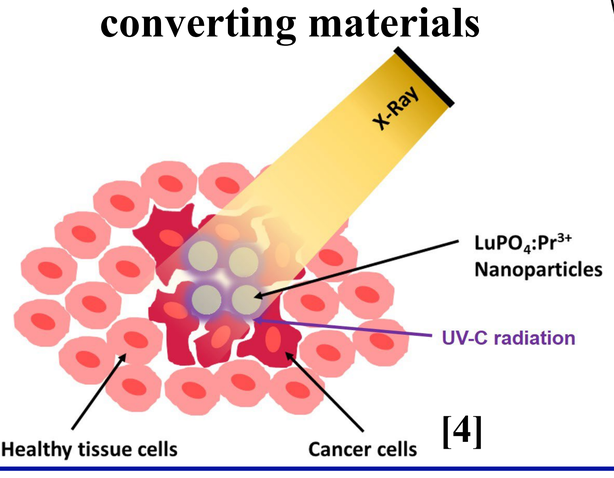




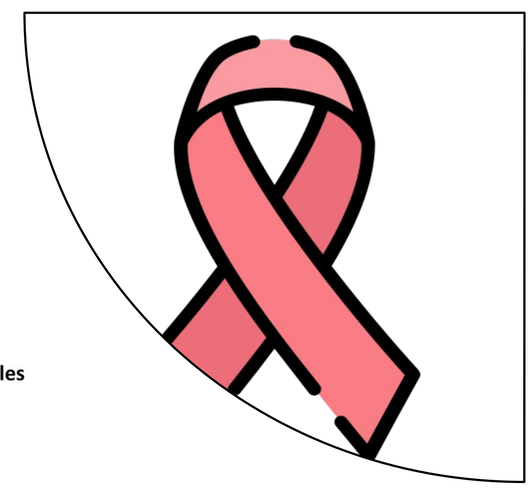
Radiation induced reduction of micro impurities in water

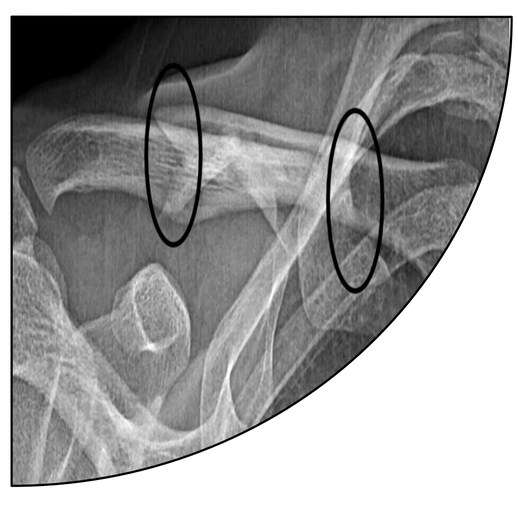


Improved radiation therapy of cancer by X-ray to UV-C converting materials

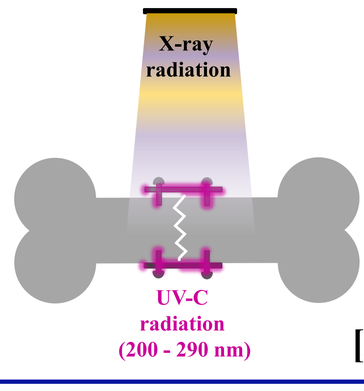


[4]



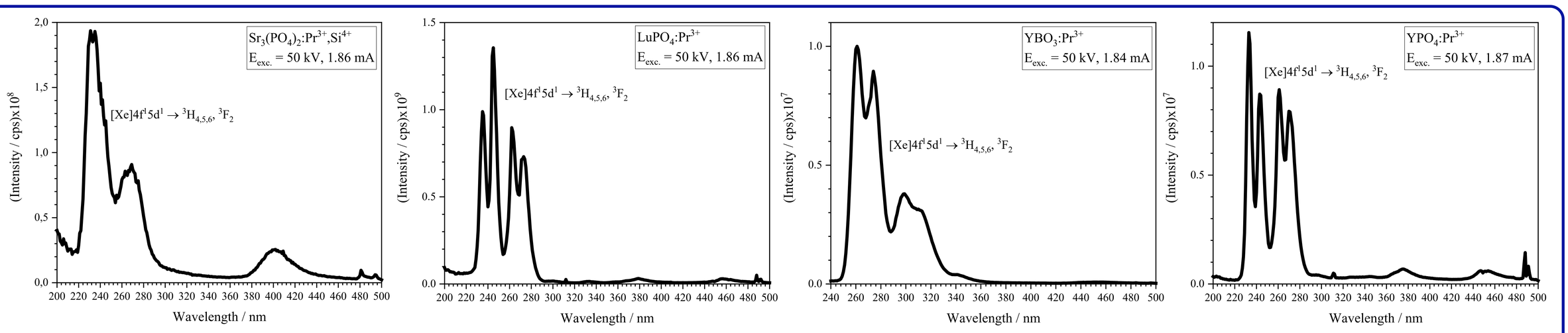


Osteosynthesis materials comprising X-ray to UV-C converting materials



[3]

Phosphors



Emission spectra of different Pr^{3+} comprising phosphors upon X-ray excitation.

Sources: [1]: www.umm.decovid19-coronavirus-aktuelle-informationen Download: 08.08.2022; [2]: https://www.waterlogic.at/blog/wasserverschmutzung-in-der-welt/ Download: 08.08.2022; [3]: Ceramic Osteosynthesis Materials Based on Rare-Earth-Doped Inorganic Compounds J.-N. Keil, J. Kappelhoff, T. Jüstel 6th European Symposium on Biomaterials and Related Areas BioMAT 2021, 05 –06 May 2021, Web Conference; [4]: Picture by J. Kappelhoff

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