Quenching of luminescence

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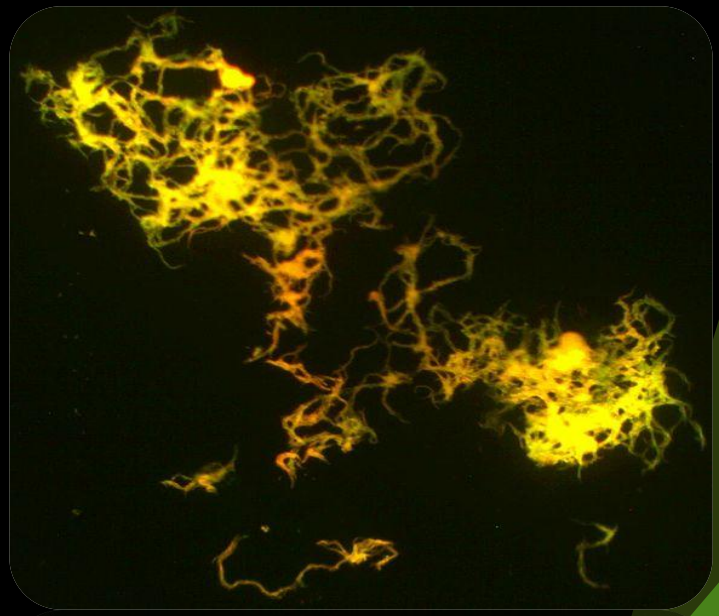
luminescence concept

- Luminescence is emission of light by a substance not resulting from heat; it is thus a form of cold-body radiation. It can be caused by chemical reactions, electrical energy, subatomic motions, or stress on a crystal. This distinguishes luminescence from incandescence, which is light emitted by a substance as a result of heating.



What is a luminescence quenching?

What is a luminescence quenching?

Quenching of luminescence – it is a decrease of luminescence output which caused various reasons. Quenching of luminescence can occur with add to phosphor impurities, in the time of increasing in it concentration of luminescent substance itself, in the time of heating with infrared light, electric field and other influence to the luminescing substance.

As a result of action of these factors the probability non-radiative transitions of the luminescing molecules from the excited state in the basic in comparison with probability of their radiating transitions relatively increases.

Different types of luminescence quenching

- Internal quenching
- Temperature quenching
- External static quenching
- Dynamic quenching
- Concentration quenching

Different types quenching of luminescence

- Internal quenching is caused non-radiative transitions of internal conversion and an oscillatory relaxation.
- Temperature quenching is a variant of internal. influenced of temperature a capability of a molecule to be deformed grows, and, as a result, the probability non-radiative transitions grows.
- External static quenching is based on interaction of the luminescing connection with other molecule and formation of not radiating product.
- Dynamic quenching is observed when the initiated molecule of a phosphor enters foreign reaction and loses the properties.
- Concentration quenching— result of absorption by molecules of substance of own radiation.

Principle quenching of luminescence

In the broadest sense as quenching of the excited states understood any processes of their deactivation which are result of interaction of the excited molecules with system components. An exit of a luminescence is very sensitive to various intramolecular and intermolecular interactions which cause his reduction and lead to develop processes of quenching of a luminescence. Are among the most active quenchers of a luminescence:

- heavy anions and cations of I^- , Br^- , Cs^+ , Cu^{2+} (at the same time $S_1 \rightarrow$ by T_1 transition is facilitated);
- paramagnetic ions and molecules O_2, Mn^{2+} , nitroxyl radicals;
- solvent molecules. Usually polar solvents, such as water possess the greatest extinguishing action;
- acceptors of electronic energy of excitement.

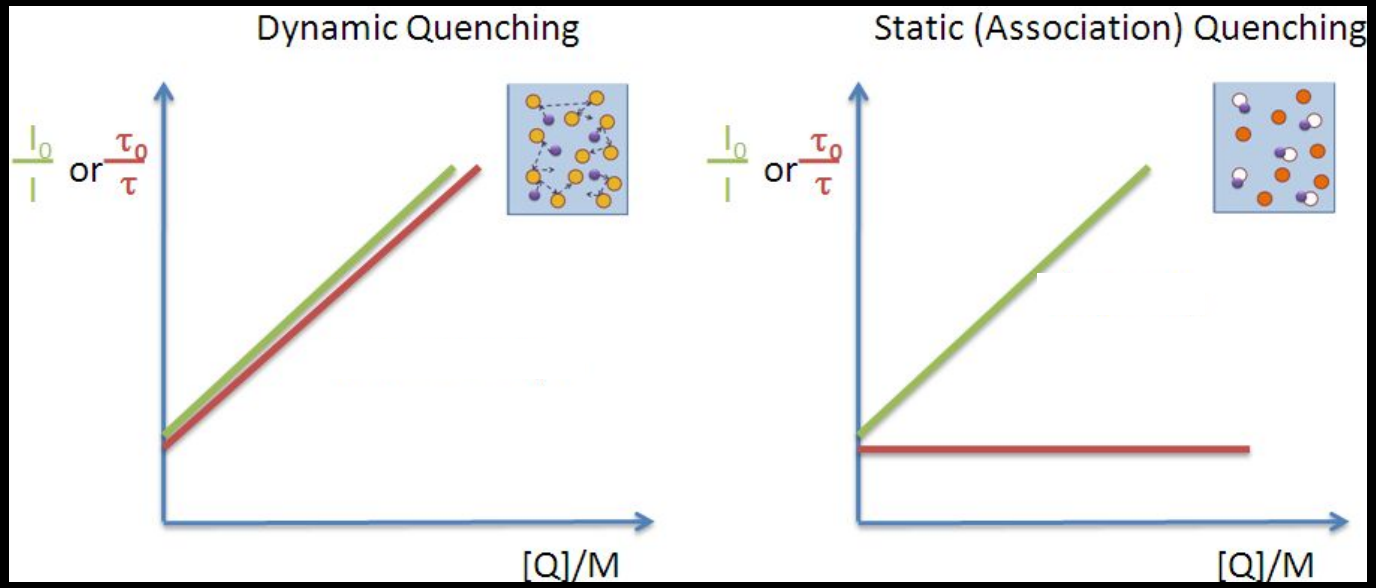
Principle quenching of luminescence

The quencher can be static (suppression of the first sort) and dynamic (suppression of the second sort).

Quenching of the first sort. All those processes in which reduction of an exit of a luminescence isn't followed by reduction of average duration of the excited state have been referred to quenching of the first sort.

Quenching of the second sort. All those processes in which reduction of an exit of a luminescence is caused by impact on the excited molecules of the researching substance during times, lives commensurable over time of the excited state have been referred to quenching of the second sort.

Principle quenching of luminescence



Because at quenching of the first sort (static) all influences are carried out on unexcited molecules, it can't affect in any way to size T, since to excited state pass only those molecules which have avoided these influences.

Quenching of the second sort (dynamic) the initiated molecules takes part in all interactions. Therefore in quenching development of such kind value T shall change significantly, i.e. a permanency T or its changes are the reliable criterion allowing to establish unambiguously the quenching nature.

Conclusion

Concluding it is possible to say that quenching of a luminescence happens at the atomic level and for quenching it is used the different principles and elements. And generally they happens static and dynamic. Quenching refers to any process which decreases the luminescence intensity of a given substance. A variety of processes can result in quenching, such as excited state reactions, energy transfer, complex-formation and collisional quenching. As a consequence, quenching is often heavily dependent on pressure and temperature.

Literature list

1. http://www.heuristic.su/
2. http://chem21.info/
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Thank you for attention!