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# EFFECT OF DOPANT IONS ON LUMINESCENCE PROPERTIES

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## ABSTRACT

Dopants are supplemental atoms with a distinct electronic orbital structure in comparison to the host crystal lattice. Thus, new energy levels will open up in the parts of the crystal near the dopant atom. In other words, there are energy levels that may host either electrons or holes inside the material's prohibited band gap. In the first scenario, the dopant is known as a donor, and the energy level is relatively near to the conduction band; in the latter, the energy level is relatively close to the valence band. If luminescence is produced as a result of level transitions, the dopant is called an activator. Activator concentrations are often very low, with detection limits as low as 1 dopant atom per 5000 host atoms and as high as 1 dopant atom per 5 billion host atoms. Doping the host material with activators creates the phosphors used in vacuum tube video display tubes. Doping zinc sulfide (ZnS) with silver (Ag) or chlorine (Cl) yields blue light, whereas doping ZnS with copper (Cu) or aluminum (Al) yields green light, and doping yttrium oxide disulfide (Y2O3S) with europium (Eu) yields red light. Since the 3d outer shells of transition metals like Ag and Cu are only partly filled, their transitions are very sensitive to the local crystal field. Nevertheless, the electron may be pushed back into the conduction band by applying a little amount of heat, from whence it may decay easily into the valence band. This is how thermo luminescence works as a scientific method. The amount of light that certain materials emit when heated may be used as a dating tool. How long it has been since the initial excitation was promoted to the electrons is calculated by counting the number of electrons still stuck in the shallow levels.