Electron paramagnetic resonance in the materials science

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Magnetic resonance (MR) is an indispensable technique in Physics, Chemistry, Geology, Biology, Materials Science and Medicine due to the fact that an MR spectrum carries unique information about the interactions of an elementary magnetic dipole (i.e. electron or nucleus) with its surrounding. MR is a microscope on an atomic and subatomic level.

The MR includes Electron Paramagnetic Resonance (EPR), Nuclear MR, Ferromagnetic and Antiferromagnetic Resonance. The present talk will be dedicated to the EPR and its applications to Materials Science.

Chemical substances which can be investigated by means of the EPR include all substances containing nonzero electron spins, such as:

- All transition metal (TM) ions;
- All atoms with an odd number of electrons (i.e. H, N);
- Ions with one (ns)–electron (Ga^{2+}, Sn^{2+}, Ge^{2+}, Te^{2+});
- Free radicals;
- Colour centres in solids;
- Molecules in a triplet state with $S = 1$ (i.e. O_2, irradiated naphthalene);
- Molecules with an odd number of electrons (i.e. NO, NO_2);
- Conduction electrons in metals and semiconductors;
- Shallow donors and acceptors in semiconductors;
- Radiation defects and other deep centres in semiconductors.

An elementary introduction to the EPR technique will be illustrated by several practical examples.

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