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Chemical Bonding: Importance and Conceptions

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Short Communication

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ABSTRACT

Every chemistry curriculum has two main topics, atomic structure and chemical bonding and its theories, which form the fundamental base towards understanding advanced chemistry concepts like reactivity, spectroscopy, and organic chemistry. The main corrigendum about chemical bonding is that the concepts are mostly abstract, as the interactions between atoms in a molecule can only be visualized and not be observed experimentally. However, it still attracts the researchers' attention even today, as it is one of the core areas which define the bond types in a molecule.

The attractive force which holds various constituents (atom, ions, etc.) together and stabilizes them by the overall loss of energy is known as chemical bonding. Therefore, it can be understood that chemical compounds are reliant on the strength of the chemical bonds between its constituents; The stronger the bonding between the constituents, the more stable the resulting compound would be.

The opposite also holds true; if the chemical bonding between the constituents is weak, the resulting compound would lack stability and would easily undergo another reaction to give a more stable chemical compound (containing stronger bonds). To find stability, the atoms try to lose their energy.

Whenever matter interacts with another form of matter, a force is exerted on one by the other. When the forces are attractive in nature, the energy decreases. When the forces are repulsive in nature, the energy increases. The attractive force that binds two atoms together is known as the chemical bond.

INTRODUCTION

Chemical bonding studies have focused on the many perspectives: covalent, ionic, and metallic bonding, intermolecular forces, and chemical bonds and energetics. There are numerous bond theories given to modulate the picture of atomic and molecular bonds. Valence Shell Electron Pair Repulsion (VSEPR) is one such theory which could give the first possible picture on the 3D geometry of a molecule in terms of the lone pair-lone pair, lone pair-bond pair, and bond pair-bond pair repulsions. Valence Bond Theory (VBT) designated the geometries in terms of the bonding orbitals used by the atoms in each molecule. The concept of "hybridization" was originated to better understand the coupling of atomic orbitals to form these molecular orbitals, which can be further classified as bonding, anti-bonding, and non-bonding. After this, the

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introduction of Molecular Orbital Theory (MOT) revolutionized the way the geometry and organization of electrons in the orbitals. Phenomena like paramagnetic behavior could be possible only due to MOT. In addition to this, the linear combination of atomic orbitals (LCAO) was also utilized to support the classification of electrons into bonding, anti-bonding, and non-bonding. MOT could also explain the bond order of a bond in a molecule. Further, MOT could also relate to the excited state geometries of few of the diatomic molecules [1,2].

Applications

Some of the applications of chemical bonding applications are listed below:

- For insulation, spray bonding of high loft airlaid batts with binders having acrylic groups.
- Polyamide fibre abrasive pads for automotive and finishing of metal components.
- Cleaning cloth for the outside portion of aircraft. It consists of a needlepunched web sprayed on one side with a styrene butadiene slurry (containing hydropropyl methylcellulose and nitrile rubber particles).
- Roofing membranes impregnated with bitumen can be based on needlepunched fabrics saturated with a relatively hard styrene acrylate binder.

Other applications of chemical bonding include polymers, mineralogy, nonwoven developments as geotextiles, important steps of adhesively bonded repairs, understanding the behavior and properties of thin films for biomedical applications, chemically-bonded ceramics, nanocarbons, high-temperature oxidation of ZrN powder in O_2 atmosphere, and structural, and organization properties of various materials [1,2].

CONCLUSION

Chemical bonding is the root concept involved towards gaining a comprehensive knowledge on the structure and reactivity of all categories of the day-to-day molecules of practical relevance. Hence, getting to know about the various bonding styles in a chemical molecule can lead to astounding results and new paths of technology-driven world.

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