

Inorganic Chemistry

B.Sc Part-I, Group-B-3,

Resonance or valence bond Theory

[Rest Part of metallic bond] WK-10

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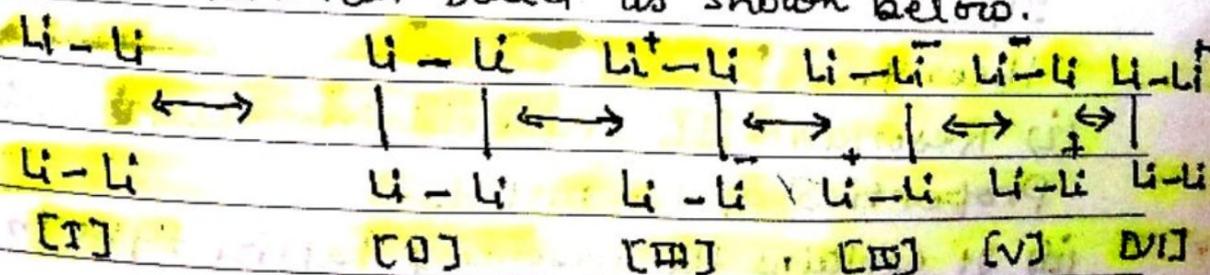
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Lecture Notes Series :- 08

Resonance or valence bond theory

This theory was suggested by Pauling (1937). According to this theory, the metallic bonding is essentially covalent in origin and metallic structure exhibits resonance of electron pair bonds (i.e. normal covalent bonds) between each atom and its nearest neighbours.

Let us consider the crystal structure of lithium metal whose electronic configuration is $1s^2, 2s^1$ i.e. one valency electron. X-ray studies have shown that it has eight nearest neighbors one valency electron of lithium is not sufficient to form electron pair bonds between each lithium atom and all its eight neighbours. Therefore it is proposed that resonance takes place throughout the lithium solid as shown below.



Here only four atoms are shown in these

Structure,
The actual

S	M	T	W	T	F	S	S	M	T	W	T	F	S
-	-	-	-	-	-	1	2	3	4	5	6	7	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28

Notes



includes all the atoms of the crystal in three dimensional plane. The structure III, IV, V and VI contain lithium atom with a negative charge which is bonded to other two lithium atom by two co-valent bonds. These covalent bonds are resonating covalent bonds.

The above structure is possible because there is a slight difference in the energies of 2s and 2p orbitals of Li-atoms. An electron from 2s orbital of one atom is transferred to a vacant 2p orbital of another atom to form Li-ion with the configuration $1s^2, 2s^1, 2px^0, 2py^0, 2pz^0$. In the above type of interaction, only the outer most orbitals and electrons are involved. The electrons in the inner shells of the various metal atoms (eg $1s^2$ in case of Li metal) remain localised in their atomic orbitals.

Advantages

These are following advantage of resonance theory.

(i) Resonance theory explains the magnetic properties of the metals.

(ii) It explains the presence of lattice type in the metals.

(iii) It explains the increases in metallic properties to a maximum value followed by

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०९ फाल्गुन शुक्ल, बुधवार, सं० २०७६ value and then regular decrease on the basis of filling of electrons in valency shell.

Limitation

(i) It does not explain the thermal and electrical conductivity, metallic lustre, and decrease in conductance with increase in temperature

(ii) It does not explain semi-conductor.