

(d_{xz} , d_{yz}). If it is assumed that d orbitals (or a higher s orbital) are not used for energetic reasons, it can be concluded that the carbon atom of (I) uses sp^3 (or more correct: sp^2) hybrids.

For (II) (symmetry group C_{2v}) we found that $\Gamma_\sigma = 2A_1 + B_1$. In this case, the A_1 orbitals s , p_z , $d_{z^2-y^2}$ and d_{z^2} and the B_1 orbitals p_x and d_{xz} are found. It follows therefore that the σ bonds consist of $sp_x p_x$ hybrids. However, we should also consider the six possible π bonds which will transform by the symmetry operation in the same way as a set of six vectors attached to the three atoms surrounding the carbon atom. The two vectors on each atom must lie in a plane perpendicular to the bond with the carbon atom and also be at right angles in respect of each other. By application of the various symmetry operations we derived that $\Gamma_\pi(\perp) = A_2 + 2B_2$ and $\Gamma_\pi(\parallel) = A_1 + 2B_1$.

Considering $\Gamma_\pi(\perp)$ it may be found that the appropriate orbital for A_2 is d_{xy} and those for B_2 are p_y and d_{yz} . Again, the d orbitals

are neglected for energetic reasons, so that only p_y is left. In the case of $\Gamma_\pi(\parallel)$, the energetically allowed orbitals belonging to the irreducible representations A_1 and B_1 , have been used already for the formation of the σ bonds. For the bonding of the methylene radical to the metal surface, one σ hybrid and one p_y orbital—the latter being perpendicular to the plane of the adsorbed species—are available.

This conclusion is in agreement with the suggestion of Rooney (1) that bonding of $\alpha\alpha$ -diadsorbed intermediates takes place by means of one σ bond and one π bond.

REFERENCE

1. ROONEY, J. J., *Chem. Britain* **2**, 242 (1966).

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Announcement

The Fourth International Congress on Catalysis will be held from 23 to 29 June 1968 in Moscow. The theme of the Congress will be "Principles of the Prediction of Catalytic Action."

For copies of the circulars, submission of papers (abstracts are due not later than July 15, 1967, and papers not later than September 15, 1967), and other information, please apply to Dr. B. D. Polkovnikov, Secretary, Fourth International Congress on Catalysis, Leninskii Prosp. 47, Institute of Organic Chemistry, Academy of Sciences of the USSR, Moscow B-334, USSR.