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Subtle Bond of Carbon Tetrafluoride (Yin yang)

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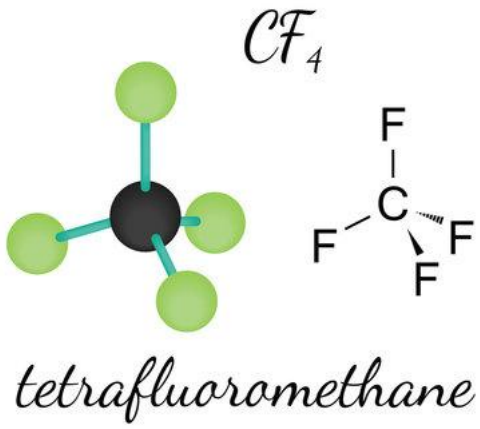
Abstract: *The subtle bond of carbon tetrafluoride is presented.*

Keywords: *carbon tetrafluoride (tetrafluoromethane), double surface characteristics, subtle bond, forming and disconnecting energy*

1. Introduction

Carbon tetrafluoride (CF_4) has a central carbon atom (C) surrounded by four fluorine (F) atoms. Carbon has four valence electrons, and fluorine has seven. Hence, carbon requires four more electrons, and fluorine requires one electron to complete its octet. Therefore, carbon bonds with four fluorine atoms through single covalent bonds, resulting in a tetragonal structure. In such a structure, all bonds are equidistant with a bond angle of 109.5°. [1]But electrons are not at rigid rest and even fluorine atoms could be connected on some way.



2. Double Surface Characteristics of Curved Distance between Fluorine Atoms

The distance between fluorine atoms in CF_4 yields 214.75 pm [2]which expressed in Compton wavelengths of the electron equals $88.509\lambda_e$. The curved distance is π- times longer. Yielding $278.059\lambda_e$ it is very close to the stable subtle orbit length$n = 278\ \lambda_e$ as well as to the unstable subtle orbit length $2\ x\frac{n}{2} = 2\ x\ 139\ \lambda_e = 278\lambda_e$,, both measured on the elliptic surface. And yet closer to the unstable subtle orbit length $2\ x\ s\left(\frac{n}{2}\right) = 278.071\ \lambda_e$, measured on the average elliptic-hyperbolic surface. Since respecting the double-surface geometry we apply the relation [3]:

$$s(n) = n\left(2 - \frac{1}{\sqrt{1+\frac{\pi^2}{n^2}}}\right), n \in \mathbb{N}. \quad (1)$$

And calculate the stable subtle orbit length $s(n) = s(278)$:

$$s_{stable} = s(278) = 278\left(2 - \frac{1}{\sqrt{1+\frac{\pi^2}{278^2}}}\right) = 278{,}018. \quad (2)$$

To compare:

$$s_{measured} = 278{,}059 > s_{stable} = 278{,}018. \quad (3)$$

And calculate the unstable subtle orbit length $2x\ s(\frac{n}{2}) = 2\ x\ s(139)$:

$$s_{unstable} = 2x\ s(139) = 2\ x\ 139\left(2 - \frac{1}{\sqrt{1+\frac{\pi^2}{139}}}\right) = 278{,}071. \quad (4)$$

To compare:

$$s_{measured} = 278{,}059 < s_{unstable} = 278{,}071. \quad (5)$$

The measured curved distance between fluorine atoms in CF_4 thus expresses favourable double surface characteristics since it lies between the stable and the unstable subtle orbit length:

$$s_{stable} = 278{,}018 < s_{measured} = 278{,}059 < s_{unstable} = 278{,}071. \quad (6)$$

Applying equation (1) and taking into account $Ry = 13.605693009\ eV$ and $\alpha^{-1} = 137.035999146$ at forming a stable subtle bond between fluorine atoms in CF_4 the next energy should be released (signed negative):

$$\Delta E = Ry.\alpha^{-1}\left(-\frac{1}{\frac{s(n)}{2}} + \frac{1}{s\left(\frac{n}{2}\right)}\right) = Ry.\alpha^{-1}\left(-\frac{1}{\frac{s(278)}{2}} + \frac{1}{s\left(\frac{278}{2}\right)}\right) = -0.003\ eV. \quad (7a)$$

And for disconnecting the subtle bond the same energy should be consumed (signed positive):

$$-\Delta E = +0.003\ eV. \quad (7b)$$

3. EXPLANATION

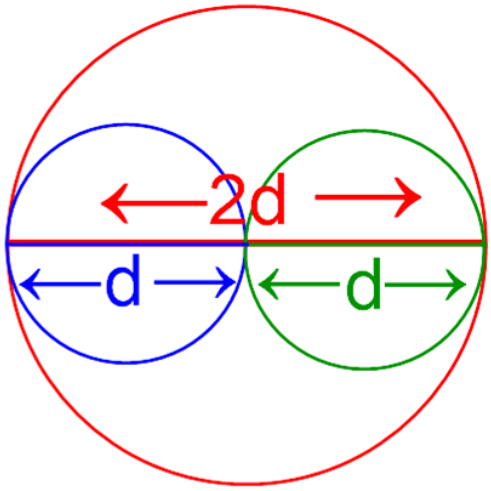


Figure1. *Subtle bond characteristics*

Subtle bond is a lasting attraction on the double surface between equal neighbour atoms on the distance $D = 2d$ (diameter of red circle) providing the movement of pair of electrons on one half of stable subtle bonding orbit of length $\frac{s(\pi d)}{2}$ (half of red circle) and cancelling the movement on one of two unstable subtle antibonding orbits of length $s(\pi\frac{D}{2})$ (half of blue and half of green circle) between neighbour atoms.

On the double surface the subtle bonding length $s_{bonding}$ is shorter than the subtle anti-bonding lengths$s_{antibonding}$:

$$s_{bonding} = \frac{s(\pi D)}{2} < s_{antibonding} = s\left(\frac{\pi D}{2}\right). \quad (8)$$

And the corresponding subtle bonding energy $E_{bonding}$ is lower than the subtle anti-bonding energy$E_{antibonding}$:

$$E_{bonding} = -\frac{Ry\alpha^{-1}}{\frac{s(\pi D)}{2}} < E_{antibonding} = -\frac{Ry\alpha^{-1}}{s\left(\frac{\pi D}{2}\right)}. \quad (9)$$

So, at forming a subtle bonding the energy is released (signed negative):

$$\Delta E_{forming} = E_{bonding} - E_{antibonding} = Ry.\alpha^{-1}\left(-\frac{1}{\frac{s(\pi D)}{2}} + \frac{1}{s\left(\frac{\pi D}{2}\right)}\right) < 0. \quad (10a)$$

And for disconnecting the subtle bonding (forming the anti-bonding) the energy is consumed (signed positive):

$$\Delta E_{disconnecting} = -\Delta E_{forming} > 0. \quad (10b)$$

4. SIMILARITY

In Figure 1, one can see the outline of the yin yang symbol [4]

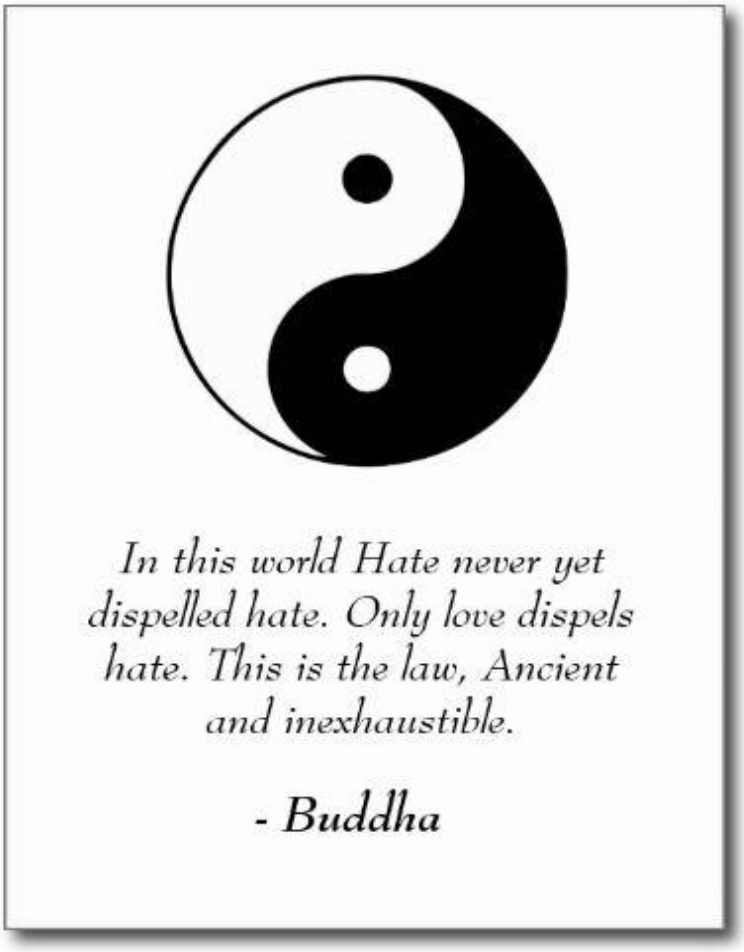


Figure2. *Yin yang*

DEDICATION AS CONCLUSION

To yin yang

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[2] CCCBDB listing of experimental geometry data page 2 (nist.gov). Retrieved Oktober 2023

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