

Astrochemically Relevant H-Atom-Abstraction and H-Atom-Addition Reactions Connecting Fulminic Acid (HCNO) and Formaldoxime (H₂CNOH)

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Today one of the central questions of astrochemistry is how H₂ is formed in dense molecular clouds. Because of the low pressure in the interstellar medium the possibility of the 3-body-collisions is low, which means that the H₂ cannot be formed from 2 H-atoms in gas phase. According to recent theoretical studies it is possible that H₂ is generated in catalytic cycles¹. In the catalytic cycles two H atoms forms an H₂ molecule not directly but with the help of a catalyst.

The aim of our research work was to investigate the catalytic cycle of fulminic acid (HCNO) and formaldoxime (H₂CNOH). The molecules were trapped in *para*-H₂ matrix at 3.1 K. Then, H atoms were generated in the matrix. In *para*-H₂, the H atoms can diffuse efficiently by tunnel effect, which enabled the examination of its reactions (H-atom-addition and H-atom-abstraction reactions) with the trapped molecules. The chemical changes were followed by IR spectroscopy.

According to our experimental results, HCNO and H₂CNOH can react with H atoms at 3.1 K. This observation indicates that the same reactions might also occur at 10–20 K in the dense molecular clouds which means that these reactions can catalyze the H₂ formation in the ISM. The experimental results have shown that the quantity of HCNO and H₂CNOH is connected to each other through a quasi-equilibrium reaction. This quasi-equilibrium is shifted towards the HCNO, which may explain why H₂CNOH has not been detected yet in the ISM.

1. Vidali, G., *Chemical Reviews* **2013**, 12, 8762-8782