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Molecular Rotators on a Silicon Surface

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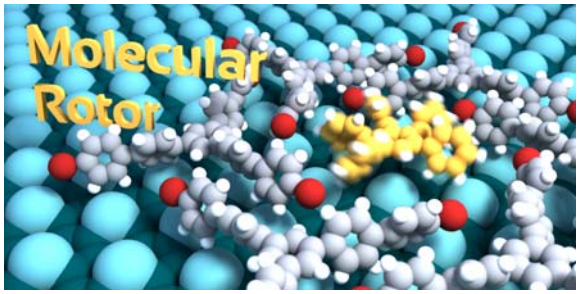
The formation and control of rotors adsorbed onto a surface are one of the most promising challenges in nanotechnology [1-2]. In the present study we demonstrate the remarkable achievement of thermally-activated rotation of pentaphenylbenzene molecules within nanopores formed in a self-assembled supramolecular network on a silicon based surface. Pentaphenylbenzene is composed of five phenyl rings attached to a central aromatic core, where the 6th position on the central ring is vacant. This vacancy works as an excellent marker in STM images for an easy identification of static position, step-by-step rotation and continuous rotation. We have demonstrated by STM experiments, performed from 77 to 150 K, and theoretical calculations that the pore geometry and molecule-surface interaction are key factors in controlling the symmetrical positioning and onset of rotational motion. Furthermore, our ability to control surface temperature allows the determination of activation energy for mobilizing either individual or groups of these 5-lobed rotor structures in the nanoscopic pores. We think that this study opens new avenues for studying the controlled dynamics of molecular machines fabricated on semiconducting surfaces.



Molecular rotor adsorbed in open supramolecular framework on a silicon-based surface

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[2] D. Kühne, F. Klappenberger, W. Krenner, S. Klyatskaya, M. Ruben, J. V. Barth. Rotational and Constitutional Dynamics of Caged Molecules, *PNAS* **2010**, *107*, 21332-21336.