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Binding Structures of Diatomic Molecules to Co-Porphyrins on Au(111) Studied by Scanning Tunneling Microscopy

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Axial bindings of diatomic molecules to metalloporphyrins involve in the dynamic processes of biological functions such as respiration, neurotransmission, and photosynthesis. The binding reactions are also useful in sensor applications and in control of molecular spins in metalloporphyrins for spintronic applications. Here, we present the binding structures of diatomic molecules to surface-supported Co-porphyrins studied using scanning tunneling microscopy. Upon gas exposure, three-lobed structures of Co-porphyrins transformed to bright ring shapes on Au(111), whereas H₂-porphyrins of dark rings remained intact. The bright rings are explained by the structures of reaction complexes where a diatomic ligand, tilted away from the axis normal to the porphyrin plane, is under precession. Our results are consistent with previous bulk experiments using X-ray diffraction and nuclear magnetic resonance spectroscopy.

Keywords: Metalloporphyrin, Scanning tunneling microscopy, Diatomic molecule