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Molecular Design for the Formation of Two-dimensional Molecular Networks: STM Study of γ-phenylalanine on Au(111)

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The self-assembly of γ-phenylalanine on Au(111) at 150 K was investigated using scanning tunneling microscopy (STM). Phenylalanine can potentially form two-dimensional (2D) molecular networks through hydrogen bonding (through the carboxyl and amino groups) and π-π stacking interactions (via aromatic rings). We found that γ-phenylalanine molecules self-assembled on Au(111) surfaces into well-ordered structures such as ring-shaped clusters (at low and intermediate coverages) and 2D molecular domains (intermediate and monolayer coverages), whereas α-phenylalanine molecules formed less-ordered structure on Au(111). The self-assembly of γ- but not α-phenylalanine may be related to the flexibility of the carboxyl and amino groups in the molecule. Moreover, as expected, the 2D molecular network of γ-phenylalanine on Au(111) was mediated by a combination of hydrogen bonding and π-π stacking interactions.

Keywords: self-assembly, amino acid, π-π stacking interactions