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A Single Molecule View of Bi-stilbene Photoisomerization Using Scanning Tunneling Microscopy¹

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The advent of scanning tunnelling microscopy (STM) has permitted a detailed atomic view of organic molecules adsorbed on solid surfaces. With the use of the STM, we present an unprecedented direct single-molecule perspective on the cis-trans photoisomerization of stilbene molecules within ordered-monolayers physisorbed on the Ag/Ge(111) surface. The STM view of the molecular structure transformation upon irradiation provides a direct evidence for the generally accepted one-bond-flip mechanism proposed for the photoisomerization process. We also find that the surface environment produces a profound effect on the reaction mechanism. The reaction is observed to proceed mainly through pairs of co-isomerizing molecules situated at domain boundaries. To explain these observations, we propose a mechanism whereby excitation migrates to the domain boundary and the reaction occurs through a biexciton reaction pathway.

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