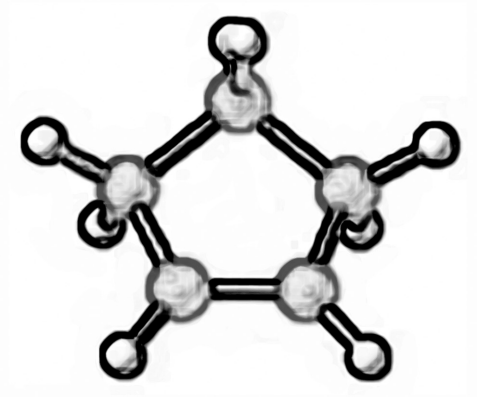
Current-Driven Phenomena in NANOELECTRONICS



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To my family

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Preface

From small amplitude vibration to desorption and reaction, tunneling electrons can induce a variety of fascinating phenomena in the molecular moiety of a heterojunction. Potential applications of current-driven dynamics in molecular-scale electronics range from sensitive surface spectroscopies to new forms of molecular machines. Proper understanding of current-driven dynamics in junctions is required also in order to suppress undesired consequences, such as heating and current-induced failure. From a theoretical perspective, dynamical events in junctions involve the interesting challenge of accounting for strongly nonadiabatic dynamics subject to bias voltage and the dissipative effects of the electrodes. From an experimental perspective, they involve the challenge of observing and manipulating single molecules.

In the following chapters you will find what I personally consider a beautiful collection of experimental and theoretical studies of current-driven events in molecular nanojunctions. The book opens (Chapter 1) with a fundamental study of the solid-molecule interface that underlies much of the functionality of molecular devices. In Chapters 2 and 3 we turn to studies of small amplitude vibration and its application in inelastic surface spectroscopies. One of the major consequences of current-driven vibrations, namely heating, is the topic of Chapters 4 and 5. The last two chapters conclude with demonstrations of current-driven large amplitude dynamics, including mechanical motions (Chapter 6) and surface nanochemistry (Chapter 7). I hope that you will find these studies inspiring and enjoyable.

Tamar Seideman

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