I would like to take this opportunity to thank my advisor, Dr. C. Patrick Collier, for his support during the past five years. He treated me as an equal colleague from the first day I was in his lab, which I had not expected at all. My PhD committee, composed of Drs. William A. Goddard, Jesse L. Beauchamp, and Robert B. Phillips, have been kind enough to offer tremendous help, sometimes unsolicited, along my way toward graduation. Not only was my research improved by their insightful questions posed during committee meetings, but I was fortunate enough to have conversations with them about the general practice of science as well. I will always be motivated by their devotion to science and education, which I witnessed as a student in and outside the classroom and lab.

My labmates have always been a great source of reliable help. Ian Shapiro is always ready to help me with optics. Yoshie Narui taught me how to use the stopped-flow instrument and volunteered to take a lot of public responsibility in the lab. Jason Gamba showed me the operation of the confocal microscope and cheered on the progress we made in research. Chen Jinyu generously offered me a ride the first week he moved to Pasadena, and shared his experience without reservation. Garrett Bittner was the first one I met in the group and helped me with the first thing I did—obtaining the group account. As a SURF student, Raman Shah left impeccable lab notes which saved us a lot of time when we had to reconstruct his setup later. Dr. Hyun-gil Jung showed me the first experiment I learned at Caltech and impressed me with his perseverance and industry. It was also nice talking with Dr. Maria Espandiu who never hesitated to encourage my research. Dr. Donato Ceres was kind enough to loan me his fancy Canon SLR camera for imaging experiments and was always ready to offer his opinion when I had a question. I had many pleasant conversations on various topics with Dr. Tai-hwan Ha who appeared to be in the lab all the time; he also showed me how to use the Olympus microscope. Although I did not have a lot of interaction with Dr. Jongwon
Kim, I learned the importance of being well organized from his presentation in which every literature reference was followed by an apparently universal index number. Among all the labmates, I owe the most to Dr. Seung-yong Jung. We have been working closely on the same projects, which would be impossible without his devotion of time and effort. He was always willing to share his valuable experience and increase his own workload. I wish him the best of luck in his new position and future endeavors.

My colleagues are definitely not limited to the group. I spent a considerable amount of time in the Micro–Nanofabrication Lab in Watson, managed by Alireza Ghaffari. As the master of the public facility, Ali kept it running 24/7 for researchers with a wide array of projects and backgrounds. He is the person I turn to first whenever there is a technical issue. It would take forever to list all the help I got from him. I am also grateful to the colleagues I have been working with in the facility for their kind tolerance of my mistakes and generous suggestions on my research. Heng Xin showed me the protocol of the thermal evaporator. Christina Morales and Dr. Saurabh Vyawahare shared both their reagents and protocols, helping me get started as soon as possible. Chiu Hsin-Ying and Hareem Tariq provided valuable tips for working with the e-beam writer. I also had enjoyable conversations with Cui Xiquan, Zhang Kechun, Lee Lapman, Robert X. Bao and others in the noisy environment of a clean room. I am also indebted to the Molecular Materials Resource Center, directed by Dr. Bruce S. Brunschwig, for freely using their instruments. The Beckman Imaging Center at Caltech was also essential in providing access to confocal microscopes. Additionally, the Phillips lab was willing to squeeze microscope time to give me a chance to do my experiments, which I greatly appreciate.

Caltech is a great place for graduate students. All the staff members I talked to are willing to help. Dian Buchness, Laura Howe, Agnes Tong, and Anne Penney in chemistry department provided continuous support to me from orientation to graduation. Friends in Braun House taught me how to cook decent Chinese food when I did not even know how to make steamed rice. The senior Chinese students—Pang Changlin, Ouyang Xiaoxi, Wu Jian, Zhang Chengzhong, Jin Zhipu and Shi Ling—took me out for dinner and shopping in Chinese neighborhoods every week until I got my own car, since I was not able to get used to either American or Mexican cuisine. The house representative Valarie Norton devoted her own time to set up the computer room where I could work on my code.
any time I wished. I also benefited from lectures offered by various departments. Some of my TAs, including David Wu, Effrosyni Seitaridou and Liu Jian, continued to provide valuable input to my research. As a TA myself, I had the privilege to work with Drs. Douglas Rees, Vicent McKoy and Sunney Chan and was given the opportunities to practice teaching with the bright undergraduates at Caltech. Outside the classroom, I enjoyed fine dinners with Dr. McKoy and Dr. Chan, and illuminating conversations on career issues with Dr. Rees and Dr. Chan.

I was not able to spend enough time with my parents during these years, but they always support my decision. My wife, Yang Fan, and her family also understand my busy schedule. I am extremely fortunate to have Fan at my side to share all the laughter and tears. Facing a problem, she is the one sitting with me to work out a solution. With her support, I cannot imagine anything that is impossible. Fan’s advisor, Dr. Pamela Björkman, and her group members were kind enough to tolerate my use of their facility.

Finally, I am dedicating this thesis to Fan and our son, who are collectively extending my horizon everyday.