# Investigating sources and sinks of organic aerosol: $NO_3$-initiated oxidation of isoprene and heterogeneous oxidation of organic aerosol

Thesis by

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In Partial Fulfillment of the Requirements for the degree of

Doctor of Philosophy

CALIFORNIA INSTITUTE OF TECHNOLOGY

Pasadena, California

2011

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# Acknowledgments

While only my name appears on the front of this work, it is the result of a collective effort studying a complex system, one involving instrumental development, laboratory and field studies, data analysis, and – as in many human experiences – tedium and drama, frustration and elation. I am honored to have navigated the scientific challenges and emotional vicissitudes with the support of a great team of collaborators and friends.

A constant force in the development of this work has been the intellectual vibrancy of Paul Wennberg and his group. In addition to Paul, John Crounse, David McCabe, Andreas Kürten, Jason St. Clair, Fabien Paulot, Nathan Eddingsaas, Melinda Beaver, and Coleen Roehl provided essential guidance on countless aspects of this work, although the support and encouragement of group members with whom I did not directly collaborate has been invaluable as well.

The Wennberg group's blatant ignorance of boundaries led me to collaborate with John Seinfeld, Richard Flagan, and their group at the Caltech environmental chamber. Here, Jesse Kroll, Nga Lee (Sally) Ng, Arthur Chan, Jason Surratt, Man Nin Chan, Puneet Chhabra, Shane Murphy, Armin Sorooshian, Scott Hersey, Havala Pye, Beth Kautzman, Lindsay Yee, and Christine Loza broadened my perspectives by introducing me to the practices of aerosol science and integrating me into their tight-knit community.

Outside of these two groups, I am also indebted to Janet Hering and Jared Leadbetter, who provided me with initial laboratory experience during my first year as a graduate student, Nathan Dalleska, who informed me with his analytical expertise, Rick Gerhardt, the glassblower who fixed many of my mistakes, and Rick Paniagua and his team at the Physics machine shop, who taught me about the design and construction of the custom components that make much of this work possible. Outside of Caltech, I am also grateful for the opportunities to do field work sponsored by the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA), which exposed me to different techniques and perspectives in atmospheric chemistry; my coauthors on Chapter 4 were especially helpful, but there are many other investigators whom I met during these missions and subsequent science team meetings who were generous with their time and knowledge to help me gain a foothold in a complicated field. Finally, my outside committee members, Mitchio Okumura and Alex Sessions, also deserve recognition for taking time out of their work to lend their fresh perspectives onto mine.

Lastly, this work is the result of efforts of many strangers, some recognized as Carlylian giants though most consigned to anonymity by history, whose struggles and ultimate successes have allowed me to live in an age and a place where living past one's 30th birthday is commonplace, and where I have the freedom to pursue my own dreams and make my own mistakes. Many in this world and in history have not shared my good fortune, often through no fault of their own. Regardless of this work's ultimate impact, I should be thankful that I had the opportunity to pursue it.

Brief mentions don't do justice to everyone's contributions, and I have likely neglected to mention many. Any omissions in acknowledgments, as well as any errors contained in the work that follows, are entirely my fault.

# Abstract

Secondary organic aerosol (SOA) are important components in atmospheric processes and significantly impact human health. The complexity of SOA composition and formation processes has hampered efforts to fully characterize their impacts, and to predict how those impacts will be affected by changes in climate and human activity. Here, we explore SOA formation in the laboratory by coupling an environmental chamber with a suite of analytical tools, including a gas-phase mass spectrometry technique that is well suited for tracking the hydrocarbon oxidation processes that drive SOA formation. Focusing on the oxidation of isoprene by the nitrate radical, $NO_3$, we find that reactions of peroxy radicals ($RO_2$) to form ROOR dimers is an important process in SOA formation. The other gas-phase products of these $RO_2$ reactions differ from what is expected from studies of simpler radicals, indicating that more studies are necessary to fully constrain $RO_2$ chemistry. Finally, we examine the role of heterogeneous oxidation as a sink of organic aerosol and a source of oxygenated volatile organic compounds in the free troposphere.

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