

Preface

The purpose of this book is to quantify and describe the environmental impacts of semiconductor manufacturing for life-cycle assessment (LCA) practitioners and students, in order to enable more representative LCA of electronic products. This book describes the available analytical techniques for LCA of semiconductors, as well as a set of life cycle inventory (LCI) data for several semiconductor device types over many technological generations. Using the methods and data presented in the book, LCA practitioners can adapt these LCI for use in LCA of many types of electronic products.

The introductory chapter of this book provides an overview of the types of environmental impacts which occur in production of semiconductors, and relates a more detailed picture of the objectives of this book. A history of the published work on the topic of semiconductor LCA is outlined, to provide context to the LCI and LCA studies presented in the later chapters. Chapter 2 aims to provide the reader with a toolbox of LCA approaches, by providing an overview of methods applied in semiconductor LCA, including approaches used in policy as well as in academic research. The chapter includes a step-by-step guide to the application of generic semiconductor LCI in LCA of electronics, which may be useful to the reader in adapting LCI presented in Chaps. 4–7. Chapter 3 presents an economic perspective on the semiconductor industry with the purpose of providing an explanation of the major semiconductor product types as well as describing environmentally relevant trends in the geographic concentration of semiconductor manufacturing. Chapter 4 is a life-cycle energy analysis of CMOS logic over several technology generations, with a focus on primary energy consumption and GWP, as well as the sensitivity of impacts to production metrics and product performance. Chapter 5 presents an LCA for CMOS logic, including all environmental impact categories. LCA of flash memory is presented in Chap. 6. The topic of functional unit choice in semiconductor LCA and its impact on LCA results is explored in Chap. 7, in which multi-generational LCA of DRAM is presented. The final chapter provides an outlook for future research in the area of semiconductor LCA, and LCA of electronics and information technology.



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