

Preface

The concept of three-dimensional integration of semiconductors originated with the US patent by IBM in 1969. The patent is titled “Hourglass-shaped conductive connection through semiconductor structures” (<http://www.google.com.mx/patents/US3648131>). The original interconnect looks like an hourglass. Since 1969, the three-dimensional integration concept has spread out to semiconductor industries all over the world and more than 40 consortia and companies have been involved in this development. Forty-five years after its invention, three-dimensional integration of semiconductors is becoming very popular, and is about to be industrialized in advanced electronics in the very near future.

This book reviews the state of the art of three-dimensional semiconductor integration. Chapter 1 gives an overview of three-dimensional integration research and development history. Chapter 2 summarizes recent three-dimensional integration research and development activities and applications. Chapter 3 gives an explanation of through-silicon via (TSV) formation processes. Chapters 4 and 5 cover wafer handling, wafer thinning, and bonding of wafers and dies. Chapter 6 explains metrology and inspection. Chapter 7 discusses reliability and characterization issues. Chapter 8 covers trends in technology development of three-dimensional integration circuits testing. Finally, Chapter 9 summarizes research and development project results conducted by New Energy and Industrial Technology Development Organization (NEDO)/Association of Super-Advanced Electronics Technologies (ASET); Japan in 2008 to 2012.

We really hope that this book will help not only beginners in three-dimensional integration technology of semiconductors but also engineers who are already involved in this field, both in industry and academia. I was very much astonished when, in 2000, ASET members visited my university and asked for support to fill an interconnect via that was huge compared to the contact via created by the damascene process of copper electrodeposition. This introduction gave me the initial motivation to start my research on three-dimensional integration. Two editors,

Morihiro Kada and Kenji Takahasi, are former ASET leaders. The opportunity given by K. Howell of Springer to publish this book is very much appreciated.

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