

Preface

With the phasing out of lead-bearing solders, electrically conductive adhesives (ECAs) have been identified as one of the environmentally friendly alternatives to tin/lead (Sn/Pb) solders in electronics packaging applications. In particular, with the requirements for fine-pitch and high-performance interconnects in advanced packaging, ECAs with nano-materials or other nano-technology are becoming more and more important due to the special electrical, mechanical, optical, magnetic, and chemical properties that nano-sized materials can possess. There has been extensive research for the last few years on materials and process improvement of ECAs, as well as on the advances of nanoconductive adhesives that contain nano-filler, such as nano-particles, nanowires, or carbon nanotubes and nano monolayer graphenes.

The objective of this book is to review the most recent advances of various types of electrically conductive adhesives with the particular emphasis on the emerging nanotechnology, including materials development and characterizations, processing optimization, reliability improvement, and future challenges/opportunities identification.

This book consists of nine Chapters, each representing a specific field of interest. Chapter 1 discusses an overview of electronic packaging and the involvement of different types of conductive adhesives. Chapter 2 describes the latest development of nano-materials, nanotechnology and their applications in microelectronics packaging. Chapter 3 reviews the key polymeric materials used in conductive adhesives and the analytic approaches for ECA characterizations. Chapter 4 deals with the recent advances in materials, processes, and applications of isotropically conductive adhesives (ICAs), particularly focusing on the fundamental understanding and improvement of materials properties for ICAs and nano-ICAs. Chapter 5 discusses the recent development and applications of anisotropically conductive adhesives (ACA) with the emphasis on the nano-materials implementation for improved performance. Chapter 6 describes the latest materials and processing development of non-conductive adhesives (NCA). Chapter 7 discusses the details of conductive nano-inks and their applications in transparent electrodes, printed electronics, and other packaging areas. Chapter 8 focuses on the recent research and development of materials and applications of intrinsically conducting polymers. And finally, Chapter 9 summarizes the recent advances of conductive adhesives with nanotechnology and discusses the challenges and opportunities for continuing the work on nanoconductive adhesives.

The field of electrically conductive adhesives and nanotechnology is quite broad and their development is dynamic, so it is impossible to cover every aspect of them. We have attempted to include most major areas with the latest references which should be useful to our audience who work in this vast growing discipline. With the advances of microelectronics packaging and nanotechnology, there is always a constant need of improved materials and technology. This is a challenge that requires the continuous and active collaborative efforts between materials scientists, chemists, physicists, device and package design engineers.

We express our gratitude to many of our colleagues and friends in the field of microelectronics packaging, conductive adhesives and nanoscience and nanotechnology. Many of their published works have been cited in this book, including work published by many other experts in the fields. We would also like to thank Owen Hildreth and Angela Duan for proofreading some chapters and Steven Elliot and Andrew Leigh for editorial suggestions.

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