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Introductory Chapter: Printed Electronics

Ilgu Yun

Additional information is available at the end of the chapter

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1. Motivation

The intent of this book is to provide readers the backgrounds and trends of the printed electronics, including processes, devices, and specific areas of applications covered under the terahertz transmission of printed electronics and photonics, biomedical sensors, and intelligent textile. As the printed electronics are highlighted for low-cost and high-volume manufacturing, various processing techniques are introduced and the current development in printed electronics is also presented.

Currently, the research on the printed electronics is confronted with many issues including material and printing process issues. In addition, for the specific applications with low-cost and high-volume manufacturing, the solutions for the issues may be different depending on the applications.

Therefore, this book can allow readers to provide the fundamentals of the printed electronics in process or device levels as well as the circuit level implementation scheme for applications. Furthermore, this book can provide a clue for the readers on how to solve their current issues for their specific applications.

This book consists of six chapters. Each chapter contains a specific topic of the printed electronics including concepts and progress in current research, which can allow readers to understand the basic information and trend of current research. This can bring readers to initiate new concepts or ideas on the particular research area.

This book can be used as a reference for graduate students, engineers, and researchers in the area of the printed electronics. Some chapters present the fundamental concepts of the proposed topics and some chapters describe the advanced concept of the specific area of the printed electronics.

2. Outline of the chapters

Here, a brief outline of each chapter is introduced:

The chapter entitled “Surface Energy-Modulated Inkjet Printing of Semiconductors” describes newly developed solution processing for the small-molecule organic semiconductors and quantum dots. This chapter deals with process optimization. This chapter will allow readers to understand the technology involved in the fundamentals of surface-energy-controlled inkjet printing processing which will lead to process optimization.

The chapter entitled “Printing of Fine Metal Electrodes for Organic Thin-Film Transistors” presents the fine Ag electrodes fabricated by inkjet printing on PVA polymer substrate and incorporated into all solution processed OTFTs and circuits. It describes from the fundamentals of Organic thin-film transistor (OTFT) to the printing process of metal electrode to OTFT applications.

The chapter entitled “Screen-Printed Front Junction *n*-Type Silicon Solar Cells” presents the basic information to understand the operating principle of screen-printed front junction *n*-type silicon solar cells. Also, the detail technology for industrial application is fully described. This chapter will allow readers to address the information of screen-printed process applied for silicon solar cell manufacturing including advanced cell concepts.

The chapter entitled “Efficient Optical Modulation of Terahertz Transmission in Organic and Inorganic Semiconductor Hybrid System for Printed Terahertz (THz) Electronics and Photonics” presents the optical modulation characteristics of thin organic π -conjugated materials on Si substrate using THz time-domain spectroscopy. The study for various laser irradiation conditions for various materials is examined, which can be applied in printed electronics. This will allow readers to provide ideas on how the THz time-domain spectroscopy can be used for material-dependent characterization.

The chapter entitled “Design and Fabrication of Printed DNA Droplets Arrangement and Detection Inkjet System” describes the implementation of a thermal bubble printhead with simultaneously driving multichannel for DNA droplet arrangement. It proposes a monolithic CMOS/MEMS system with multilevel output voltage electrostatic discharge (ESD) protection system for protecting the inkjet printhead. This chapter will allow readers in the biomedical and electrical engineering areas to understand how the printed electronics can be applied in the bio or biomedical engineering field with full description of hardware implementation by electronics.

The chapter entitled “Development Trends in Electronics Printed Intelligent Textiles Produced with the Use of Printing Techniques on Textile Substrates” presents how the printed electronics can be applied in textile engineering, which will be interesting to the readers involved in research in the field of printed electronics. The hybrid research of the electrical and textile engineering is currently developed for various applications. This chapter shows the recent progress on how to apply the electrically conductive materials for wearable electronics.

Author details

Ilgu Yun

Address all correspondence to: iyun@yonsei.ac.kr

School of Electrical and Electronic Engineering, Yonsei University, Yonsei-ro, Seodaemun-gu, Seoul, South Korea

