Preface

In *The Invisible Man* (1897), H.G. Wells introduced the idea, then fictional, of a scientific route to invisibility. The protagonist used bleach and mysterious rays to make himself invisible.

This might be a time to write a book on metamaterial (MM) absorbers, since these days there are huge number of papers on this topic. In this way, one can accelerate something about the publicity situation of the field, which leaves something to be desired. At the same time, whenever a starting Ph.D. student wishes to work in MM absorbers, he or she has to fumble his/her way forward amidst a mass of scattered papers, unpublished notes, and Ph.D. theses, which are not all electronically available. It seemed to me that one coherent presentation might help.

The main purpose of this book is to provide consolidated information on the MM perfect absorbers. A brief history of the MM perfect absorber is incorporated to present the milestones of advancement. The theoretical backgrounds for and the fundamental of MM perfect absorbers are included to provide an insight on how the MM perfect absorbers work and we make them. It is also elucidated that, according to the operation frequency of electromagnetic wave on the MM perfect absorber, how differently the MM perfect absorbers are designed and made, and the behavior is changed. Methods to fabricate and characterize the MM perfect absorbers are presented in this book. The book emphasizes and elaborates the performance and characteristics of the MM perfect absorbers fundamentally, including the utilization of electromagnetically induced transparency, and practically. This book also provides recent advances on the MM perfect absorbers and the application aspects of MM perfect absorbers, such as multi-band, broadband, tunability, polarization independence, and incidence independence, to answer the present needs of the society. So far, few books have been published that incorporated the theoretical backgrounds up to the perspectives of MM perfect absorber, mainly covering many kinds of MM perfect absorbers, reflecting the practical aspects.

Few books are published in the field of MM perfect absorbers. This book includes practical aspects of MM perfect absorbers such as broadband and

tenability, provides useful insights on the aspects of practical properties and fabrication of MM perfect absorbers as well as the fundamental and application perspectives, and puts many kinds of MM perfect absorbers reflecting the practical aspects, even the MM perfect absorbers utilizing electromagnetically induced transparency, the design and fabrication, the characterization, and the perspectives into one package.

It is my hope that at least the first three and the last chapters of the book are written in a sufficiently leisurely textbook style for undergraduate and graduate students with some requisite preliminary knowledge to read it. In the remaining chapters, which are a bit of 'capita selecta,' the style becomes more succinct and the aim is rather to summarize results and give a guide to the literature. This book presents essential information not only for undergraduate and graduate students but also for the people in academe and industry in their quest for the commercial exploitation of potential MM perfect absorbers. On the other hand, the students are better to have at least some knowledge of electromagnetism, optics, and condensed matter Physics, etc., before reading it.

Since this book contains a large part of our works done in the last decade, I should thank the people who were influential to us during that period. Since majority of what I report in this book has been joint works with others, I thank, especially, my main coauthors, Joo Yull Rhee, Young Joon Yoo, and Ki Won Kim. It is clear from the text to what extent we are indebted to B.S. Tung, J.S. Hwang, Y.J. Kim, N.V. Dung, and B.X. Khuyen, who helped us with the arrangement of data, the respective proof, and the discussions. Last but not least, my gratitude goes out to Mrs. C. Zitter, Physical-science Editor of Springer at Dordrecht, and Ms. A. Kang, Associate Editor of Physical Science and Engineering of Springer-Korea at Seoul.

We hope this book will convey the excitement of metamaterial absorbers to the readers and stimulate interdisciplinary interactions among researchers, thus leading to explorations of new frontiers.

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