Preface

3D printing, different from traditional subtractive manufacturing techniques, is an additive manufacturing technology in which objects can be produced through computer-aided design without the need of molds. Since its invention in the last century, this promising technology has developed rapidly and has found numerous applications in various fields, ranging from personalized consumer products and food industry to drug delivery and tissue engineering and so on. Particularly, this versatile technology has also been used to produce personal protective equipment (e.g., face shields), medical devices (e.g., ventilator valves) and isolation wards to fight against the ongoing coronavirus pandemic.

Among various 3D printing approaches (e.g., selective laser sintering, fused deposition modeling, direct metal laser sintering, electron beam melting and stereolithography), the one based on photopolymerization, that is, polymerization reactions induced by light, is extremely attractive. In this approach, objects with well-defined structures can be created from the photopolymerization of liquid photocrosslinkable resin during light irradiation controlled by computer-aided design models. While the engineering, electronic and optical technologies of this 3D printing approach are almost mature, the design and development of high-performance printable materials/inks remains a key challenge. This book thus aims to provide the recent progress in the aspects of chemistry and materials of 3D printing with light.

Specifically, Chapter 1 contains information on the recently developed high-performance photoinitiating systems applicable to the vat photopolymerization 3D printing technology. Chapter 2 introduces the newly developed two-photon photoinitiators and their applications in 3D printing and mircofabrication. Chapter 3 critically reviews the recent advancements in the use of dyes in light-induced 3D printing. In particular, functional dyes can be exploited to create stimuli-responsive 3D-shaped polymers. Chapter 4 discusses the role of resin composition for the stereolithographic 3D printing of microfluidic devices, with a specific focus on the methods to successfully print enclosed channels of comparable dimensions to existing microfluidic technologies. The performance of printed objects in microfluidic applications is also reviewed. Chapter 5 discusses novel 3D printable photopolymerizable biomacromolecules and their applications in 3D printing of biomaterials, which demonstrate significant potential for clinical diagnosis and therapeutics. Chapter 6 introduces the principle, development and applications of photocurable 3D printing technology on the market, and puts forward some key problems of the technique which are required to be solved. Chapter 7 discusses the dual wavelength photochemistry for the polymerization reactions and the application in photocuring 3D printing. Chapter 8 introduces a 3D nanoprinting technique based on two-photon photopolymerization, which has been widely used to fabricate various functional micro-/nanodevices. Chapter 9 is dedicated to the application of photocontrolled reversible addition fragmentation chain transfer polymerization (photoRAFT) in 3D printing, which can add

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a new dimension to the current manufacturing technologies. Chapter 10 discusses the main challenges in 3D printing focusing on printing speed and applications in biomedical areas.

Finally, we would like to thank all chapter authors and De Gruyter, especially those who have been significantly impacted by the coronavirus pandemic in different cities around the world, for their efforts and contributions to the book in this challenging and tough time. Nothing lasts forever, even the worst disasters must end some day. Until the day when nature and science shall bring the disasters to the end, all human wisdom is summed up in two words: wait and hope (Alexandre Dumas).

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