Opinion
Volume 12:02, 2022

Journal of Bio ceramics Development and Applications

ISSN: 2090-5025 Open Access

A Note on Immunomodulation and Ontogenesis/Angiogenesis Three-dimensional Printing of Bio Ceramic

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Introduction

Transfer printing is an emerging deterministic assembly technique for micro-fabrication and nano-fabrication, which enables the heterogeneous integration of classes of materials into desired functional layouts. It creates engineering opportunities in the area of flexible and stretchable inorganic electronics with equal performance to conventional wafer-based devices but the ability to be deformed like a rubber, where prefabricated inorganic semiconductor materials or devices on the donor wafer are required to be transfer-printed onto unconventional flexible substrates. This paper provides a brief review of recent advances on transfer printing techniques for flexible and stretchable inorganic electronics. The basic concept for each transfer printing technique is overviewed. The performances of these transfer printing techniques are summarized and compared followed by the discussions of perspectives and challenges for future developments and applications.

Description

The last decade has witnessed the fast progresses and great achievements of flexible and stretchable inorganic electronics, which removes the planar, rigid, and brittle design constraints associated with conventional electronics via the integration of hard inorganic semiconductor materials in delicate structural layouts with flexible substrates. This technology has enabled many novel applications that are impossible for conventional electronics, such as curvilinear electronics bio-integrated electronics epidermal electronics, transient electronics, deformable opto-electronicsand many others. Shows some examples of flexible and stretchable inorganic devices with performance equal to those fabricated by established conventional technologies using well-developed inorganic semiconductor and metal materials, but in foldable, stretchable and curvilinear format.These examples include the stretchable and foldable Si-CMOS circuit curvilinear electronics), bio-integrated electronics epidermal electronics transient electronics and deformable opto- an highly stretchable AlInGaP μ-ILEDs array in and a mechanically flexed array of ultrathin, micro scale, blue LEDs.

However, the inorganic semiconductor or metal materials cannot be directly fabricated on flexible polymeric substrates using conventional fabrication technologies because the flexible polymeric substrates are not able to withstand the extreme processing conditions such as high temperature or chemical etching. A kind of manufacturing process of a flexible electronics system begins with independent fabrication of devices on wafer/donor substrate followed by assembling them onto a flexible/stretchable substrate together. Transfer printing technique, enabling the solid objects to be transferred from a donor substrate to a receiver substrate in a high yield manner, provides the most promising solution to this assembly process.This approach separates the fabrication substrates with the application substrates, bypassing the incompatibility problem of the polymeric substrates with conventional fabrication technologies which have a mature, established commercial infrastructure, thereby accelerating the commercialization of flexible and stretchable inorganic electronics have demonstrated the extraordinary capabilities of transfer printing technique to deterministically assemble a myriad of materials (also called inks) into spatially organized, functional arrangements onto various substrates for flexible and stretchable inorganic electronics. The inks for flexible and stretchable inorganic electronics in transfer printing include hard inorganic materials integrated inorganic devices (e.g., inorganic thin film transistors-TFTs, 32 inorganic light emitting diodes-ILEDs20, and solar cells and fully integrated inorganic circuits [1-5].

Conclusion

It should be noted that the inks for transfer printing are not limited to inorganic materials, but can also be other materials such as carbon materials (organic materials (There exist several reviews of transfer printing techniques focusing on materials and applications. This paper reviews the advances of transfer printing techniques for flexible and stretchable inorganic electronics (i.e., transfer printing techniques for inorganic semiconductor and metal materials, devices and circuits) from a methodological view. Fundamentals of transfer printing techniques are first introduced followed by the overview of various transfer printing techniques. These transfer printing techniques are classified based on their basic concepts and working principles, and then overviewed briefly. Finally, the performances of transfer printing techniques are compared, and some perspectives and challenges are discussed for future developments and applications.

Conflict of Interest

The authors declare that there is no conflict of interest associated with this manuscript.

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Received 03 March, 2022, Manuscript No. bda--21- 60371; **Editor Assigned:** 05 March, 2022, Pre QC No. P- 60371; QC No. Q- 60371; **Reviewed:** 17 March, 2022; **Revised:** 22 March, 2022, Manuscript No. R- 60371; **Published:** 30 March, 2022, DOI: 10.37421/2090-5025.12.208

How to cite this article: Mahesh, G. "A Note on Immunomodulation and Ontogenesis/Angiogenesis Three-dimensional Printing of Bio Ceramic. Bioceram Dev Appl 12 (2022): 208.