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Review on the Cellulose Nanofiber Composite Substrates for Flexible Electronics

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Abstract: Flexible electronics has a wide range of applications. There is a need for high-speed, flexible electronic substrates which low thermal expansion coefficients. Transparent films which can be made from cellulose nanofibers have low thermal expansion and can be served as an alternative substrate for flexible electronics. The paper discusses the reviews on the cellulose nano fiber composites used for the flexible electronics.

I. INTRODUCTION

As the demand for mobile computing increases, more than 1.5 billion mobile devices were sold in 2011 [1]. The concept of Flexible electronics can be used in displays, solar cells, smart cards, radio frequency (RF) tags, and medical implants [2].

The Recent advances have demonstrated enormous potential for high-speed flexible electronics [2,3]. Research community has demonstrated the ability to transfer silicon nanomembranes onto flexible plastic substrates to produce a thin-film transistor with a 12 GHz maximum oscillation frequency [3].

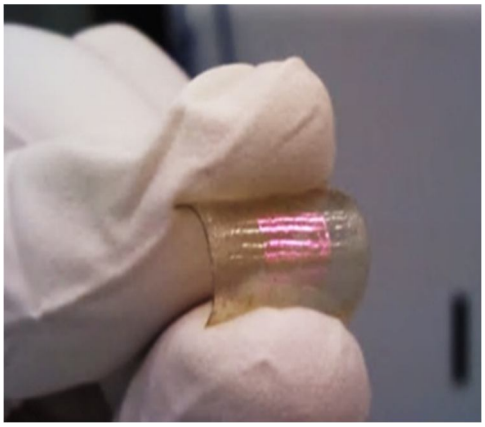
The speeds at higher oscillation frequency suggest a wide range of potential applications, including RF identification devices and wearable radios. Cellulose nanofiber composites inhibit good mechanical properties with low thermal expansion [4-6] and can serve as substrates for flexible electronics.

The devices depend on the deposition of organic light-emitting diodes deposited onto flexible substrates, where the devices have performance limitations. This paper reviews the potential possibility of cellulose nanofiber composites as a substrate for flexible electronics with the potential for high-speed applications [10].

As emphasised the electronic waste generated continues to increase and provides a serious global threat to the World [10]. There arises a need for bio-derived and biodegradable materials, such as cellulose nanofibers, which has the potential to reduce the environmental pollution due to the electronic devices.

A. Cellulose Nano Fibers – Fabrication and Testing

The Cellulose nanofibers (CNF) were prepared by Processes described in detail [8][10]. The prepared cellulose Nanofibers are used in thin-film transistors using silicon nanomembranes (SiNM) on flexible substrates has been previously described [9]. The source and drain contacts were then made on the nanomembranes prior to deposition to the CNF composite substrate with the metallic contacts created [9].The DC characteristics of the fabricated transistor were studied and tested[9].



CNF Flexible Electronic Substrate
Pic Credit: FPL Research Laboratory

The fabrication of a working thin-film transistor (TFT) on CNF substrate presents a number of challenges compared to polymer substrates. The CNF films have a tendency to absorb the low viscosity epoxy which is attached with the SiNM to the films [10]. The possibilities and usage of CNF has been explained detailed in [11]. Currently the electronics industry is focussing on the Cellulose nan0 fibre composites, though there are limitations.

II. CONCLUSIONS

The cellulose nanofiber composite substrates for flexible electronics is a good alternative to overcome the electronic waste developed, since CNF pays way for bio degradable substances.

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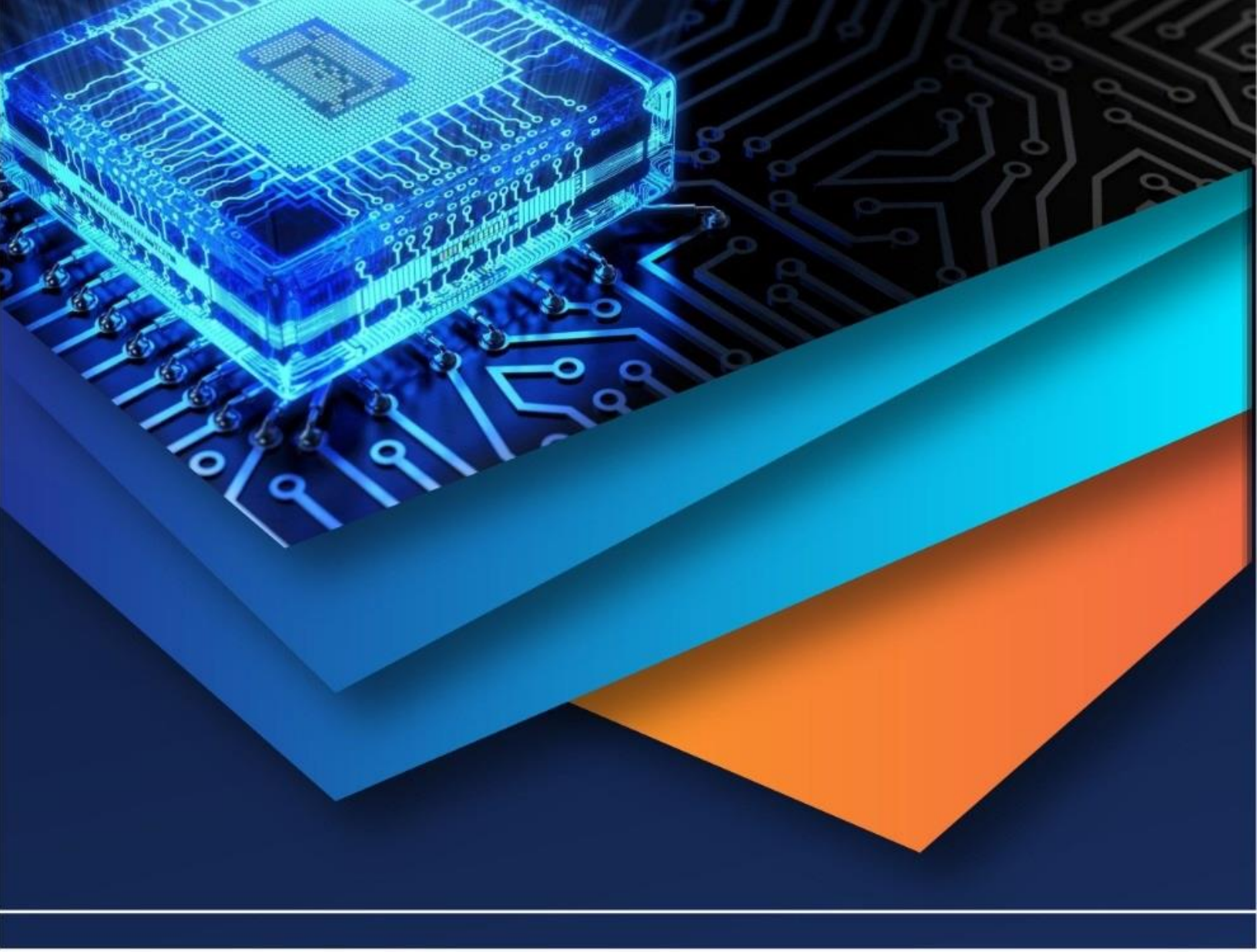

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