Mini Review
Volume 13:02, 2024

Journal of Material Sciences & Engineering

ISSN:2169-0022

Open Access

2D Ferroelectric Liquid Crystal the Next Big Thing in Display Technology

Nessie Wilson*
Department of Material Engineering, University of California, California, USA

Abstract

The discovery of ferroelectricity in 2D materials is poised to revolutionize the display technology landscape. This breakthrough promises not only to enhance the performance and efficiency of current display systems but also to pave the way for innovative applications that were previously unimaginable. This article delves into the science behind 2D ferroelectric liquid crystals, explores their potential applications, and discusses the implications for the future of display technology. Ferroelectric materials are characterized by their spontaneous electric polarization, which can be reversed by the application of an external electric field. Crosslinked polymer networks capable of absorbing large amounts of water, have emerged as promising scaffold materials for tissue engineering applications due to their biocompatibility, tunable properties, and similarity to the native extracellular matrix of tissues.

Keywords: Liquid • Crystal • Ferroelectric

Introduction

Researchers discovered ferroelectricity in a 2D material known as vermiculite. This material, a type of clay mineral, exhibits ferroelectric properties at the atomic scale, which are highly responsive to electric fields. The 2D nature of vermiculite allows for greater flexibility and integration into various electronic devices, particularly display technologies. Electric field responsivity of 2D ferroelectric materials is significantly higher than that of their 3D counterparts. This means that displays using 2D ferroelectric liquid crystals can achieve faster response times, leading to smoother transitions and better performance in high-definition video displays. One of the most critical advantages of 2D ferroelectric materials is their potential for reduced power consumption. Traditional liquid crystal displays require a continuous backlight, consuming significant amounts of energy. In contrast, 2D ferroelectric liquid crystals can maintain their state without a constant power supply, thereby conserving energy and extending the battery life of portable devices [1].

Literature Review

The use of 2D ferroelectric materials can enhance the pixel density and brightness of displays. This is due to their ability to manipulate light more precisely and effectively, resulting in sharper images and more vibrant colors. This improvement is particularly beneficial for devices like smartphones, tablets, and high-end televisions where display quality is paramount. 2D materials, by nature, are incredibly thin and flexible. This allows for their integration into flexible and foldable displays, which are gaining popularity in the market. Devices with foldable screens, such as smartphones and wearable technology, can benefit from the incorporation of 2D ferroelectric liquid crystals, leading to more durable and versatile products. The unique properties of 2D ferroelectric liquid crystals open up a myriad of applications in display technology and beyond. The primary application of 2D ferroelectric liquid crystals lies in the development of next-generation displays. These materials can be used to create ultra-thin, high-resolution, and energy-efficient screens for a variety of devices, including smartphones, tablets, laptops, and televisions. The increased brightness and color accuracy will enhance user experience across all these devices [2]. In recent years, there has been growing interest in designing and synthesizing biomimetic hydrogels that mimic the structural and functional properties of native tissues to improve their performance in tissue engineering applications. This unique property makes them highly valuable in various electronic applications, including memory devices and sensors. Traditional ferroelectric materials are typically three-dimensional, but recent research has uncovered ferroelectric behavior in two-dimensional materials, significantly broadening the scope of their potential uses.

Discussion

The flexibility of 2D ferroelectric materials makes them ideal for use in flexible and wearable electronics. Smartwatches, fitness trackers, and other wearable devices can benefit from the integration of these materials, resulting in more comfortable and durable products. Additionally, the potential for foldable smartphones and tablets can be fully realized with the use of 2D ferroelectric liquid crystals. High-performance displays are crucial for AR and VR devices, where immersion and realism are key. The high responsiveness and resolution provided by 2D ferroelectric liquid crystals can enhance the quality of AR and VR displays, leading to more immersive and realistic experiences for users. Electronic paper displays, used in e-readers and other low-power devices, can also benefit from 2D ferroelectric materials. These displays require minimal power to maintain static images, making them perfect for devices designed for prolonged use without frequent recharging [3].

The development and integration of 2D ferroelectric liquid crystals into display technology are set to drive significant advancements in the industry. As research continues, the performance of these materials will likely improve, leading to even greater efficiency and higher quality displays. The energy-saving potential of 2D ferroelectric liquid crystals aligns with global sustainability goals. By reducing power consumption in electronic devices, these materials contribute to lower carbon emissions and a smaller environmental footprint. This aspect is increasingly important as the demand for electronic devices continues to grow globally. The adoption of 2D ferroelectric liquid crystals in display technology is expected to stimulate market growth. Companies that invest in this technology will likely gain a competitive edge, driving

***Address for Correspondence:** Nessie Wilson, Department of Material Engineering, University of California, California, USA; E-mail: essieilsonnwn@gmail.com*

Received: 02 April, 2024, Manuscript No. JME-24-139009; **Editor Assigned:** 04 April, 2024, PreQC No. P-139009; **Reviewed:** 18 April, 2024, QC No. Q-139009; **Revised:** 23 April, 2024, Manuscript No. R-139009; **Published:** 30 April, 2024, DOI: 10.37421/2169-0022.2024.13.646

innovation and expanding market opportunities [4]. This growth will also foster further research and development, potentially leading to new applications and advancements in other fields of electronics and materials science. The exploration of 2D ferroelectric materials involves a multidisciplinary approach, combining aspects of physics, chemistry, materials science, and electrical engineering [5]. This interdisciplinary research will likely lead to new discoveries and innovations, not only in display technology but also in other areas such as sensors, actuators, and energy storage devices [6].

Conclusion

The discovery of ferroelectricity in 2D materials marks a significant milestone in the evolution of display technology. 2D ferroelectric liquid crystals offer numerous advantages over traditional materials, including enhanced responsiveness, energy efficiency, higher resolution, and flexibility. These properties open up a wide range of applications, from next-generation displays and flexible devices to AR/VR and energy-efficient e-paper. As research and development continue, the integration of 2D ferroelectric liquid crystals is set to transform the display technology landscape, driving innovation and sustainability in the industry. The future of display technology looks bright, with 2D ferroelectric materials leading the way toward more efficient, high-performance, and versatile electronic devices.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Al-Abboodi, Mohammed H., Fouad N. Ajeel and Alaa M. Khudhair. "Influence of oxygen impurities on the electronic properties of graphene nanoflakes." *Physica E: Low Dimen Sys Nanostruct* 88 (2017): 1-5.
2. Jalili, S., M. Jafari and J. Habibian. "Effect of impurity on electronic properties of carbon nanotubes." *J Iranian Chem Soc* 5 (2008): 641-645.
3. Giannazzo, Filippo, Gabriele Fisichella, Aurora Piazza and Salvatore Di Franco, et al. "Impact of contact resistance on the electrical properties of MoS_2 transistors at practical operating temperatures." *Beilstein J Nanotechnol* 8 (2017): 254-263.
4. Ribeiro, F. J., A. Latge, M. Pacheco and Z. Barticevic. "Quantum dots under electric and magnetic fields: Impurity-related electronic properties." *J App Phys* 82 (1997): 270-274.
5. Li, Yu-Qiong, Jian-Hua Chen, C. H. E. N. Ye and G. U. O. Jin. "Density functional theory study of influence of impurity on electronic properties and reactivity of pyrite." *Trans Nonferrous Met Soc China* 21 (2011): 1887-1895.
6. Katanin, A. "Effect of weak impurities on electronic properties of graphene: Functional renormalization-group analysis." *Phys Rev B* 88 (2013): 241401.

How to cite this article: Wilson, Nessie. “2D Ferroelectric Liquid Crystal the Next Big Thing in Display Technology.” *J Material Sci Eng* 13 (2024): 646.