

电子皮肤的压阻设计：从基础原理到应用研究

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目前,用于电子皮肤的柔性压阻传感器通常要求具备以下特点:生物相容性、柔性可拉伸、无线信号传输等。与此同时,柔性压阻传感器在应用研究方面不断取得突破与创新,包括自动报警、可视化,甚至体内植入与体征监测。

湖南大学王祖勇教授研究组对电子皮肤的压阻传感器设计原理、结构及应用进展进行了系统综述。文章首先介绍了基于材料的不同压阻响应原理,这为柔性压阻传感器的设计与制造提供理论基础。当前可用于压阻传感器设计与制造的材料主要包括金属材料、导电碳材料、半导体、导电聚合物及绝缘聚合物。随

后,文章系统综述了柔性压阻传感器的关键部件——感应结构。这些结构主要包括微凸起、裂纹、纤维、孔及复合结构,进而为柔性压阻传感器关键性能的提升提供了设计思路。文章探讨了感应结构的制备工艺与性能间的关系。进一步地,综述了柔性压阻传感器在电子皮肤相关领域的应用研究,例如健康检测、语音识别,以及假肢和机器人开发。最后,对目前柔性压阻传感器的主要研究方向进行了总结,并就未来应用前景以及面临的挑战做出展望,包括追求高灵敏度的同时避免干扰噪声、追求稳定和长期的使用性能,以及实现便携无线信号传输和收集等。这些问题与挑战的解决将依赖于柔性压阻传感器的持续创新研究。

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Piezoresistive design for electronic skin: from fundamental to emerging applications

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Design of piezoresistive sensor is based on a principle of force-induced resistance change. Generally, the flexible piezoresistive sensor used for e-skin requires multiple characteristics such as biocompatibility, flexible stretching and wireless signal transmission.

The research group of Prof. Zuyong Wang from Hunan University provide a systematic review on the design principle, sensing structure and application progress of flexible piezoresistive sensor. Firstly, this review introduced the principles of piezoresistive response based on different materials, which aimed to provide theoretical

basis for designing a functional flexible piezoresistive sensor. Subsequently, the article systematically reviewed the key component of flexible piezoresistive sensor - sensing structure. This article further summarized the application of flexible piezoresistive sensors in e-skin, such as for health detection, speech recognition, prosthetic and robot development.

Finally, the authors summarized the main research directions on flexible piezoresistive sensors as reviewed in this article and discussed the future application prospects and challenges including the continuous pursuit of a high sensitivity while avoiding interfered noise, pursuit of a stable and long-term performance, and realization of portable wireless signal transmission and collection.

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