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3D-Printed Sensors of Nanostructured Semiconducting Oxides

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3D printed sensors will play an important role in the world of modern devices and are crucial nowadays due to complexity of mounting on various equipment for the development of biomedical or monitoring systems. Mixing semiconducting oxides directly during their printing/additive manufacturing makes them attractive for detecting applications by controlling their shapes, sensitivity and reliability. This overview is intended to summarize our recent results in this domain [1-4]. Developing devices for medical applications, one has to take into account numerous characteristics (toxicity, side effect or reactions, effect of humidity on response/performances, etc.). We will show how mixed or heterostructured oxides are built by a new 3D printing approach with acetone [2,3], VOC [3], Lithium-ion batteries (LIBs) electrolytes containing e.g. LiTFSI and LiNO3 [4], and other sensing performances of emerging oxides leading to their tuning for important applications in household sensors and alarms, automotive and biomedical engineering domains [4]. Developments in the last decade were done to enhance requirements of reliability and ultralow power consumption of the 3D-sensors [3]. Thus, direct ink writing of microsensors can overcome the necessity for clean room technology. In this talk, we explain how mixed-metal oxide microsensors can be easily developed by printing of common metal nanomicroparticles. The advantages of such additive manufacturing are open porous semiconductor structure allows for sensitive VOC detection and low base conductance leads to a low power or energy efficient microsensor. The combination of the possibility to detect electrolyte vapors used in LIBs and size control by the 3D-DIW printing method make these heterostructures extremely attractive in controlling the safety of modern batteries. Also, these microdevices 3D printed directly on board or chip open new perspectives for nanoelectronics and biomedical applications.

References

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