Optimization of hydrothermal synthesis of copper oxide on flexible substrates

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Flexible sensors are a key advancement in wearable tech, adapting to various surfaces and used in medical devices and smart fabrics.[1] They are often cheaper and easier to manufacture, with copper oxide nanostructures improving electrical properties due to their reactivity and conductivity.[2] Copper(II) oxide is an excellent p type semiconductor and has in general good electrical, catalytic and antimicrobial properties.Copper oxides are ideal for flexible circuits and sensors, offering gas sensitivity, stability, and low-cost synthesis. These lightweight sensors are perfect for health monitoring, industrial safety, and environmental applications. Research into integrating copper oxide nanostructures into flexible substrates is crucial for improving sensor performance and durability.[3]

In the present study, the development of nanostructures of copper(II) oxide (CuO) was studied on top of Kapton substrate, suitable for future use in flexible sensors, with the combination of the sol-gel method and the hydrothermal synthesis.

Initially the synthesis of the oxide under different conditions was studied on silicon and gold substrates to find the ideal conditions for the development on Kapton with Cu electrodes. Next the development on the desired substrate was carried out. The conditions during the sol-gel stage were studied, while keeping the conditions for the hydrothermal synthesis the same. Specifically, the following were studied: the concentration of the sol-gel solution, the coating method of the substrate, the number of coatings, as well as the time and temperature of the heating stage after the coating. Lastly, the samples which had Kapton as substrate were characterized with different methods.

It was concluded that the development of copper(II) oxide on top of Kapton substrates was feasible, low cost and easy to apply. The formation of nanostructures of the oxide was also confirmed through Scanning Electron Microscopy (SEM), which was one of the goals of this study.

References:

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