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EFFECT OF SEED LAYER ON MORPHOLOGY ENHANCEMENT OF CHEMICAL BATH DEPOSITED ZnO NANOWIRES FOR GAS SENSING APPLICATIONS

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Metal oxide (MOx) semiconductor has stirred great attention in the gas sensors in the past decades due to the high sensitivity, fast recovery, low working temperature, and low cost. Nanowire-based MO gas sensors which possess a higher surface-to-volume ratio result in higher sensitivity and higher response to the chemical gases. However, it is crucial to synthesise long, thin MOx nanowires with uniform morphology to have superior sensing performance throughout the substrate. The chemical bath deposition (CBD) technique is a widely used technique to synthesise metal oxide nanostructures due to its relatively low-temperature growth conditions (< 100 °C), low cost, and scalability in the deposition. When considering the CBD technique, the seed layer is a significant concern for the well-growth of nanowires. Here, ZnO nanowires were grown on ZnO seeded silicon substrates, using the mixture of $Zn(CH_3COO)_2$ and monoethanolamine as the initial solution. The study aims to obtain a uniformly distributed seed layer and understand the effect of seed layer thickness on nanowire formation. ZnO nanowires were synthesised on a seeded glass substrate via CBD. Two different samples were deposited using (a) spin-coated and (b) spray-coated seed layers before carrying out low-temperature CBD. An absorption edge at 378 nm, which corresponds to the ZnO nanoparticles, was observed in the UV-visible spectra of both the spin-coated and the spray-coated seed layers. Synthesised NWs showed an absorption edge at 376 nm, confirming the presence of ZnO NWs. The SEM images show that the spray-coated seed layer was uniformly distributed throughout the surface compared to the spin-coated. After the CBD process, the nanowires grown on the spray-coated substrates were well-aligned compared to those grown on the spin-coated seed layer. Nanowires with the spin-coated seed layer were not uniformly distributed, and random clusters were found to have formed on the top of the nanowires. Therefore, the spray-coated seed layer was selected as the better method. Seed layer thickness is a major factor for the formation of vertically aligned nanowires. Thus, the number of layer stacks of the spray-coated seed layer was optimised. The obtained SEM images reveal that nanowires grown on top of 10 layers of spray-coated seed were vertically well oriented throughout the surface compared to the nanowires grown on the surface with five and eight layers of spray-coated seed.

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