Screen printed films based on copper oxides for pH sensing applications

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Screen printed pH electrodes are a good alternative to the traditional glass pH electrodes which are bulky, fragile and require wet storage. Materials such as RuO_2 and IrO_2 are popular for their good pH sensing properties but they are also expensive and quite rarely avaialable in the earth's crust. Therefore, it is vital to find materials which are abundant in the earth's environment and at the same time exhibit excellent pH sensing properties. In this study, two copper oxides (CuO_2 and CuO) were used to prepare thick film pastes, which were subsequently screen printed on alumina substrates and sintered at 850°C and 900°C. Potentiometric measurements revealed that the electrodes made of the CuO-base paste and sintered at both temperatures showed excellent sensitivity, fast response time, low drift and hysteresis, long term stability and low interference from other ions. The X-ray diffraction analysis revealed that after sintering the oxidation state of copper in the CuO_2 screen printed film changes from 1+ to 2+, thereby showing that even though the starting materials were different, the resultant phase composition of the sintered thick films was the same. However, the electrodes made of Cu_2O-based paste had pooper sensing properties, probably due to more amorphous structure of Cu_2O than CuO [1] which leads to restricted diffusion of ions in the sensing layer. Therefore, CuO as a starting material allows for relatively low sintering tempratyue, obtaining sensitivity that is comparable to currently popular metal oxides and is good candidate for application in water quality monitoring.

Biography

Kiranmai Uppuluri completed her masters in environmental technologies and engineering from Ghent University, Belgium. She is the holder of the Marie Skłodowska-Curie Fellowship and is currently developing water quality sensors with special emphasis on the environmental impact of the materials and fabrication processes.