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NICKEL-FUNCTIONALIZED SOLID-STATE TITANIA NANOTUBE ARRAY FOR THE ELECTROCHEMICAL DETECTION OF BREATH-BASED BIOMARKERS IN COLORECTAL CANCER

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Colorectal cancer (CRC) is the second most common cancer in the United States with approximately 137,000 new cases each year, 50,000 of which are fatal due to belated screenings [1]. The gold-standard detection method is colonoscopy, a direct visualization tool that facilitates the removal of minor polyps [2]. The benefits, however, come with severe drawbacks such as prohibitive cost, extreme invasiveness, lengthy preparation and high complicacy [2]. Recently, breath-based volatile organic compounds (VOCs), or biomarkers, that are specific to colorectal cancer patients have been found, detection of which may provide a diagnosis of colorectal cancer [3]. This study aimed to synthesize a titanium dioxide nanotube array (TNA) sensor capable of detecting four critical breath-based biomarkers diagnostic of colorectal cancer: cyclohexane, 1,3 dimethylbenzene, methylcyclohexane, and decanal [3]. The TNA was synthesized via standard anodization procedures and functionalized with electrodeposited nickel. XPS studies showed this nickel was $Ni(OH)_2$ on the surface, capable of oxidizing the four VOCs to facilitate their detection. The VOCs themselves were detected amperometrically. The sensor was not only able to detect all four VOCs, but the detection profile for each VOC was also distinct indicating unique interactions between $Ni(OH)_2$ complexes and the VOCs. Reaction mechanisms have been proposed to explain features observed in peak currents. The sensor has demonstrated itself to be a potentially portable, cost-effective, and non-invasive diagnostic tool that resolves problems found in current CRC diagnostic methods.

References

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