Title: Lanthanum strontium cobalt ferrite [$La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$] alloyed impedimetric sensing platform for human papillomavirus type 16 mutant DNA detection

Author names: Santheraleka Ramanathan , Ismariza Ismail , Thangavel Lakshmipriya , Subash C.B. Gopinath , Pachaiappan Raman , Yeng Chen h, Firdaus Hariri , Abubakr M. Idris

Abstract: Human papillomavirus type 16 (HPV-16) is a leading cause of cervical cancer among women worldwide. This study presents an electrochemical impedance spectroscopy (EIS)-based biosensor for the sensitive and selective detection of HPV-16 mutant DNA. A single-stranded DNA probe complementary to the target sequence was immobilized on a gold interdigitated electrode (G-IDE) modified with lanthanum strontium cobalt ferrite $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$ (LSCF) nanopowder to enhance charge transfer. The synthesized LSCF, composed of ~32 nm discrete cubic particles, was characterized by electron microscopy, XRD, and SAED, confirming its crystalline structure. FTIR indicated metal-oxygen bonding, while Raman spectroscopy revealed oxygen and carbon non-stoichiometry in the perovskite. The developed sensor achieved a limit of detection of 0.0213 fM, with a tested detection range from 1 fM to 1 nM and a linear dynamic range from 1 fM to 100 pM ($R^2 = 0.9983$). Selectivity was confirmed using mismatch and non-complementary strands, which produced negligible impedance changes. These results demonstrate the potential of the LSCF-G-IDE biosensor as a promising platform for future point-of-care HPV diagnostics.

Keywords: Antigenic HPV-16, Electrochemical impedance, Alloys, Cervical cancer, Geno sensing, Biomarker

10.1016/j.talanta.2025.128765