

## ABSTRACT

The present invention relates to a logic gate, comprising a metamaterial surface enhanced Raman scattering (MetaSERS) sensor, comprising (a) alphabetical metamaterials in the form of split ring resonators operating in the wavelength range of from 560 to 2200 nm; and (b) a guanine (G) and thymine (T)-rich oligonucleotide that can, upon presence of potassium cations ( $K^+$ ), fold into a G-quadruplex structure, and in presence of  $Hg^{2+}$ , form a T- $Hg^{2+}$ -T hairpin complex that inhibits or disrupts the G-quadruplex structure formed in presence of  $K^+$ , as well as methods of operating and using such a logic gate.

Figure 4