Proc. of the Intl. Conf. on Nanotechnology for Better Living, 2016
Editors K. K. Kar, A. Shah and R. Sharma
Vol. 3, No. 1, p. 162
doi:10.3850/978-981-09-7519-7nbl16-rps-162

Conductor backed plasmonic coplanar waveguide based broadband directional coupler for nanoscale wirelss links

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The main limitation with the nanostrip structures is the very low and narrow realizable range of impedance values (8 Ω - 30 Ω), which limits the design of other plasmonic components [1]. Therefore, a new alternative to design compact plasmonic components based on plasmonic coplanar waveguide is investigated and reported in this paper. The coplanar structure offers the advantages of wide range of realizable impedances (10 Ω - 220 Ω) and it also permits both series and shunt connections of the circuit elements very easily in comparison to nanostrip waveguides [2].

A surface plasmon coplanar waveguide (CPW) structure, shown in Fig 1(a), is a planar transmission line consisting of a conducting metal strip of width S and thickness t printed onto a dielectric thin film of thickness d, together with a pair of return conductors called ground planes, one to either side of the strip.

Conductor backed plasmonic CPW structure, shown in Fig 1(b), have a metal layer beneath the dielectric layer covering its entire surface. This layer acts as the third conductor of the structure, which helps in enhancing the coupling mechanism. A branch-line coupler designed using this structure is shown in Figure 2.

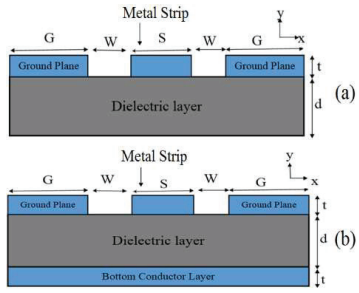

Figure 1: Schematic of the surface plasmon (a) coplanar waveguide (CPW) structure, (b) conductor-backed coplanar waveguide (CBCPW) structure

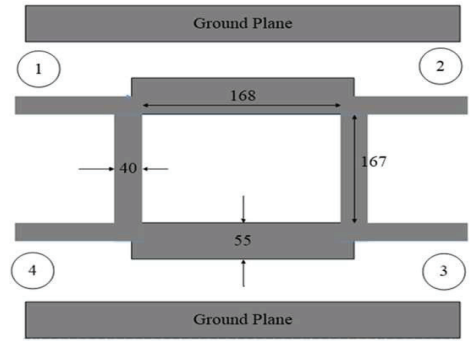

Figure 2: Top view of the SP conductor backed coplanar 3-dB branch line coupler. All the parameters are in nanometer scale

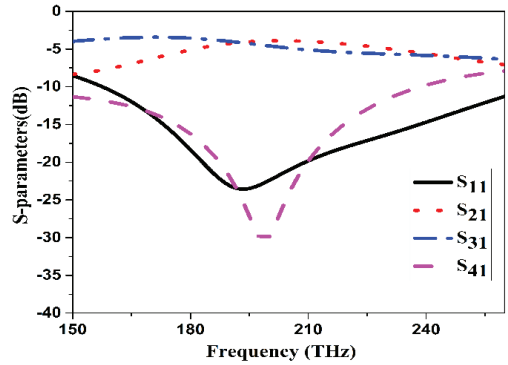

Figure 3: Top view simulated parameters of the SP conductor backed coplanar branch-line coupler

It shows a very broad bandwidth covering all the telecommunication wavelength ranges (Figure 3) and, hence, can be used efficiently in nanoscale wireless links.

References

1. Amir Hosseini, Hamid Nejati, and Yehia Massoud, IEEE Int. Sym. On Cir. and Sys. (2008) 2346.
2. Volker J. Sorger, Rupert F. Oulton, Ren-Min Ma and Xiang Zhang, MRS Bulletin 37 (2012) 728.