ABSTRACT

Surface Plasmon-Polaritons (SPPs) are bound electromagnetic waves that occur at the interface between a metal and a dielectric as a result of the interaction between electromagnetic fields and collective oscillations of free electrons. This study aims to model the dispersion relation of SPPs at the aluminum–dielectric interface using a mathematical approach based on Maxwell's equations and the Drude model. Simulations were performed by varying four types of dielectric materials: vacuum (ϵ=1), silicon (ϵ≈11.68), sapphire (ϵ=9), and germanium (ϵ=15.8), to observe the effect of permittivity on SPP propagation characteristics. The simulation results show that the wavevector k at a given frequency increases with increasing dielectric permittivity, indicating more localized waves. This comparison highlights the significant role of dielectric permittivity in influencing SPP propagation characteristics, which is relevant for optical sensor and nanophotonics applications. This study contributes to the fundamental understanding of plasmonics and provides a theoretical foundation for future experimental work.

***Keywords** : Surface Plasmon Polaritons, aluminum, dispersion relation, Drude model, metal–dielectric interface.*