

Modeling of Electromagnetic Behavior of Composite Thin Layers using Genetic Algorithm

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Abstract : In this paper, we present a new model using the highfrequency electromagnetic simulator for several binary mixtures where the load is in the lossless thin film form with a permittivity of ($\epsilon = 100, 200, 300, \text{ and } 400$) and for various thickness values in a range of $10 \mu\text{m}$ to $250 \mu\text{m}$ with respect to the host matrix. The model operates in a variety of frequencies from 8.2 GHz to 12.4 GHz . The effective permittivity of composites is evaluated using Nicholson Ross Weir (NRW) algorithm in a rectangular waveguide. The implementation of NRW algorithm is conducted on various samples simulated by HFSS, in order to estimate the dielectric composite behavior. Furthermore, we employ a genetic algorithm methodology (GA) for the filling factor optimization of the proposed model by Mosallaei. The obtained results show a good agreement with the theoretical models, which ensure the validity of our proposed model for characterizing the electromagnetic behaviour of dielectric thin films.

Keywords : Thin films, electromagnetic behaviour, dielectric mixtures, Genetic optimization, micro wave.