Electrical Characterization of Coplanar Waveguides on FlexTrateTM

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Introduction

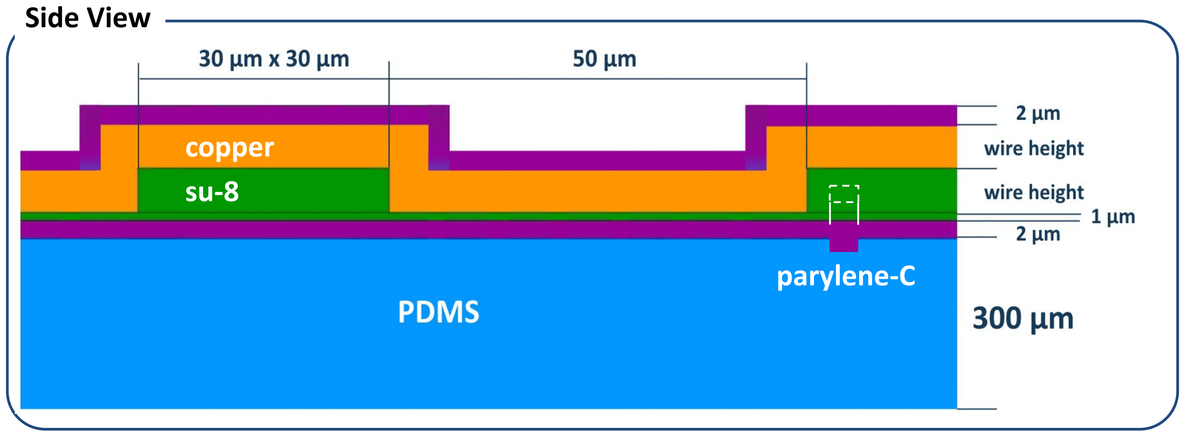
Goal: Characterization of electrical characteristics of FlexTrate interconnects up to 5GHz

- Simulations conducted using Ansys HFSS
- Samples fabricated and measured to validate simulations
- RLGC characteristics extracted from simulation results

Simulation Set Up

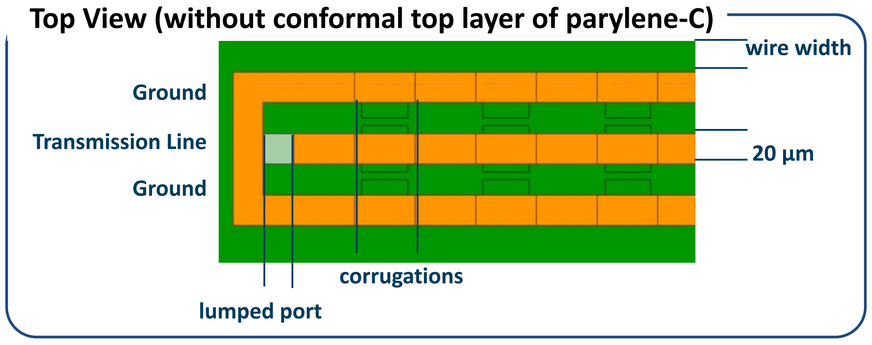
Full 3D Coplanar Waveguide Model in ANSYS HFSS

Side View



*not to scale

Top View (without conformal top layer of parylene-C)



Wire Width	Wire Height
2.5 µm	1 µm
5 µm	1 µm
10 µm	2.5 µm
20 µm	5 µm

Constants Used (determined through research papers/production):

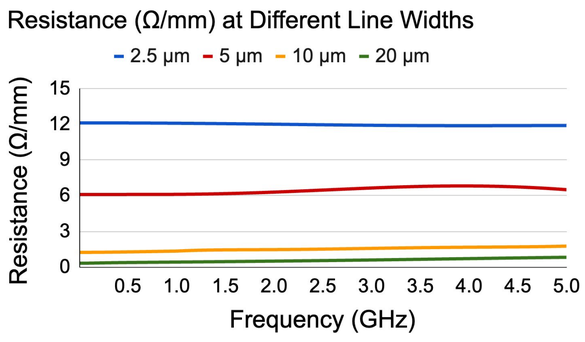
Material	Parylene-C [1]	Su-8 [2]	PDMS [3]
Dielectric Constant (K)	3.1	2.85	2.75
Loss Tangent (tan(δ))	0.001	0.03-0.045	0.0375-0.045

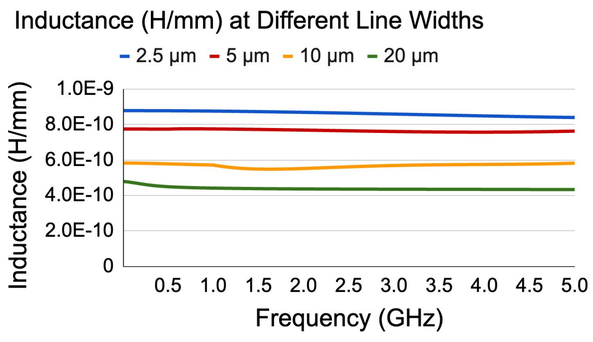
[1] https://vsiparylene.com/parylene-properties/
[2] Ayad Ghannam, e.g., EuMC, 2009
[3] N. J. Farcich, e.g., IEEE Transactions on Microwave Theory and Techniques, 2008

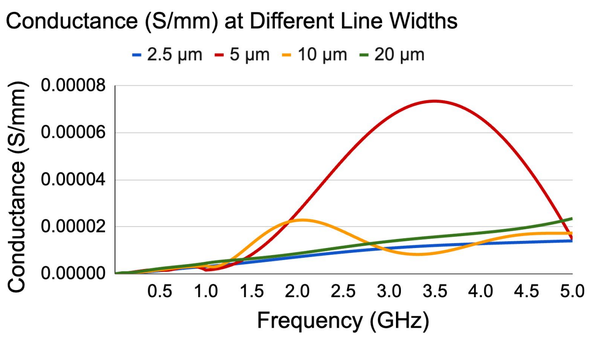
RLGC Results

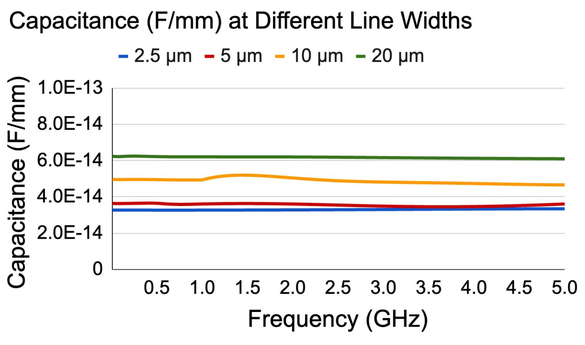
- Script written in Matlab converts Z-parameter simulation results to RLGC:

RLGC Graphs for Each Line Width





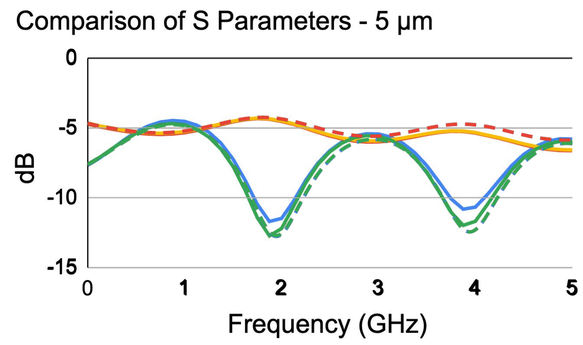


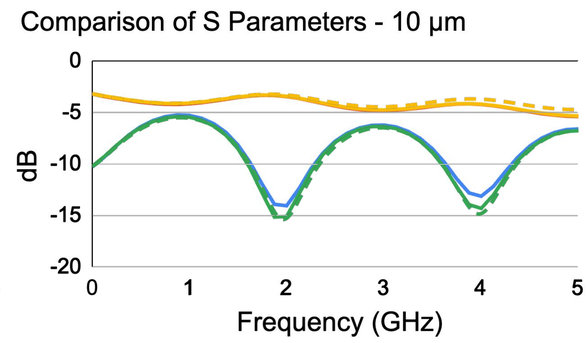


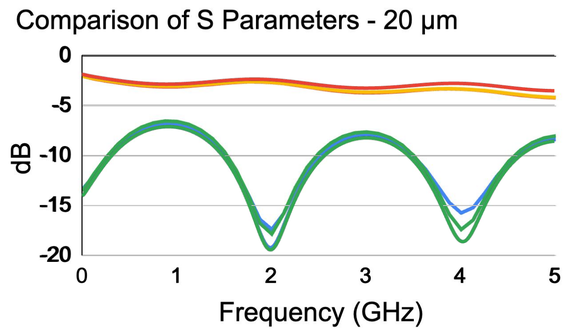
Experimental Validation of Simulations

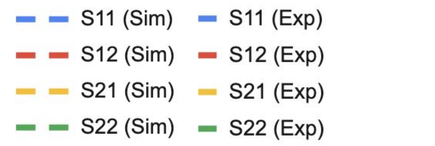
- Fabricated sample with 5 µm, 10 µm, and 20 µm trace widths, 50 mm trace length, and 20 µm spacing following simulation set up

Simulation vs Experimental S-Parameters





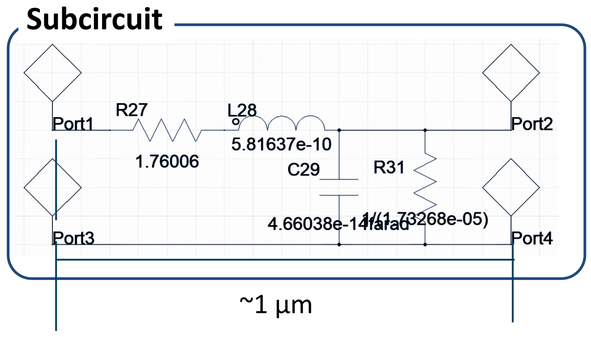




- Simulation S parameters of experimental dimensions similar to actual experimental S parameters

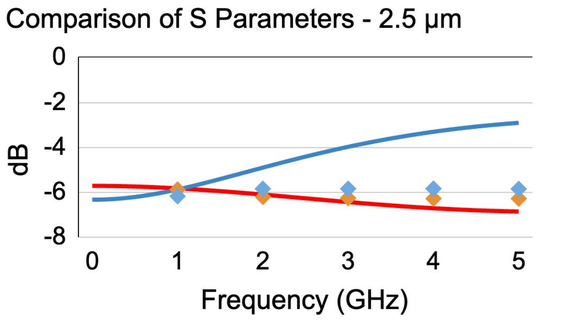
RLGC Verification

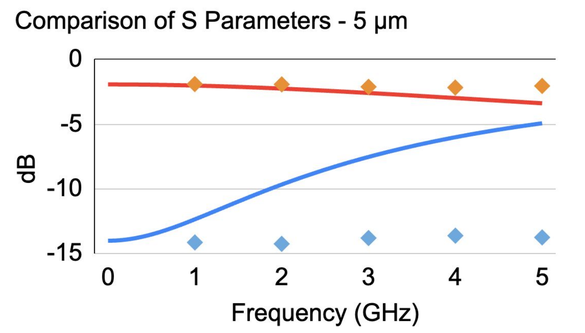
Subcircuit

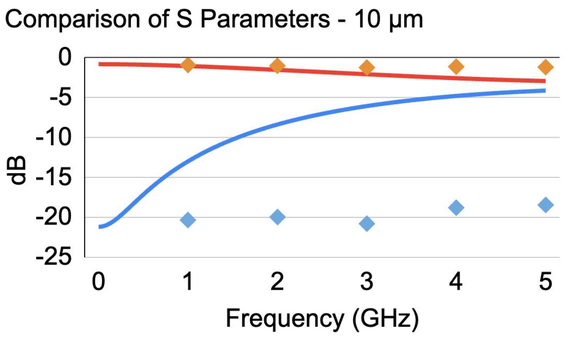


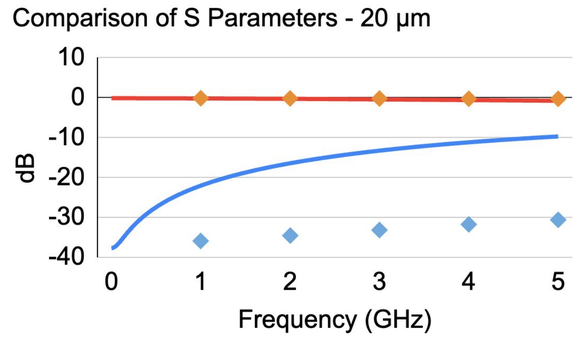
- Subcircuit model of transmission line (~8 µm) with SPICE RLGC circuit in HFSS
- Full circuit solved for S-parameters at 1, 2, 3, 4, and 5 GHz for each wire width

Simulation vs SPICE S-Parameters









- Insertion loss from the simulation is similar to the SPICE model for all line widths
- Return loss from simulation starts around the same value as SPICE model before large deviation

Conclusions and Acknowledgements

- Electrical characteristics of FlexTrate interconnects were extracted from experimentally validated simulation data
- Further investigation into return loss deviation underway

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