Universität Stuttgart

Institut für Robuste Leistungshalbleitersysteme

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Master Thesis

RF

Design and Investigation of Power Combining and Splitting Structures in a Coplanar Topology Processed using Ultraprecise Deposition Techniques

Motivation:

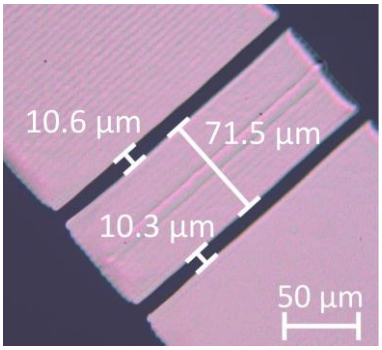
A key component of transmitters at high frequencies is the power amplifier (PA), which is usually the last stage in the transmitter chain and responsible for the output power. At high frequencies, the generation of RF power is challenging due to technological limitations. Placing several amplifiers in parallel increases the achievable output power. Depending on the needed output power, primarily due to temperature issues, it can be beneficial to realize the parallelization in the package rather than on-chip. In order to parallelize several amplifiers, in the package, power combining and splitting structures are needed. Common ways to fabricate high power packaging (e.g. split block or PCB modules) are often very expensive or limited in performance. In contrast, at IGM, a low-cost RF packaging technology using ultraprecise deposition (UPD) printing to fabricate coplanar waveguides (CPW) and derived structures has recently been developed. UPD uses a high viscosity silver nano-ink that is deposited on RF substrates through a very thin nozzle and can achieve precision comparable to the back-end-of-line in chip fabrication. In this thesis, jointly supervised by ILH and IGM, the existing approach should be expanded to fabricate and measure package-level power combining and splitting structures using the expertise in RF design and measurement at ILH and the technological capabilities and know-how at IGM.

Goals:

- Developing of a high power E-Band amplifier RF module with Several parallelized amplifiers in order to generate high output powers.
- E-Band amplifiers produced in the IAF 50nm mHEMT process should be used
- Packaging on a substrate connected by printed CPW power combiner.

Tasks:

- Design and comparison of several CPW power combining/splitting structures with different topologies and substrates using 3D simulation tools
  - Simulation in Keysight EMpro
  - Investigation of the influence of process variations on the performance
  - Design in Keysight advanced design systems and RFpro
- Mask design, printing layout and fabrication of the structures at IGM.
- RF characterization of the structures at ILH



UPD-printed CPW

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IGM Institut für Großflächige Mikroelektronik

ILH