Universität Stuttgart

Institute of Robust Power Semiconductor Systems
Institute for Large Area Microelectronics

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Investigation of Flexible Wire-Bondable Surfaces for THz Assemblies

Introduction

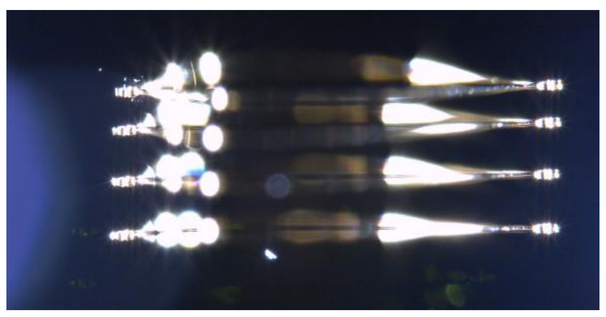
THz systems are envisioned to play an important role in the communication infrastructure of the future. With ultra-large absolute bandwidths of over 100 GHz, massive data rates are achievable, enabling a replacement of difficult-to-install fiber-connections by wireless radio signals for applications requiring flexibility of the setup. With the ever-increasing performance of semiconductor technologies, the assembly and packaging of the circuits is often the bottleneck that limits system-performance. Current packaging solutions are either too expensive, too lossy or not robust enough for a commercial application. ILH and IGM are jointly developing alternative packaging technologies for MMIC-assemblies, focusing on robustness, bandwidth and cost. A key building block are wire-bondable thin-film metallizations for THz-assemblies.

Tasks

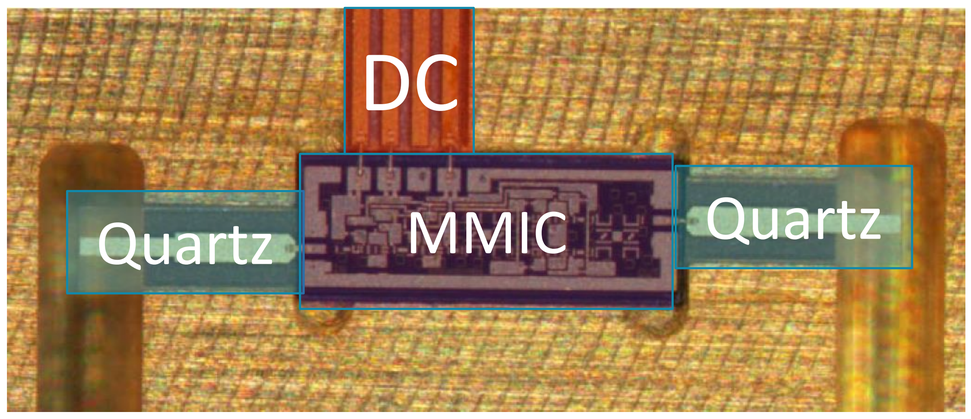
- **Literature research on the current state-of-the-art in THz-circuit packaging and assemblies**
- **Deposit and structure various thin-film metallizations on flexible substrate materials in IGM's cleanroom**
- **Conduct wire-bond tests on the flexible substrates with ILH's wire bonder and determine the process windows for good quality wire bonds**
- **In case of a master-thesis you additionally design, simulate, fabricate and measure a bond-wire-based THz-interconnect between two substrates.**

Goals

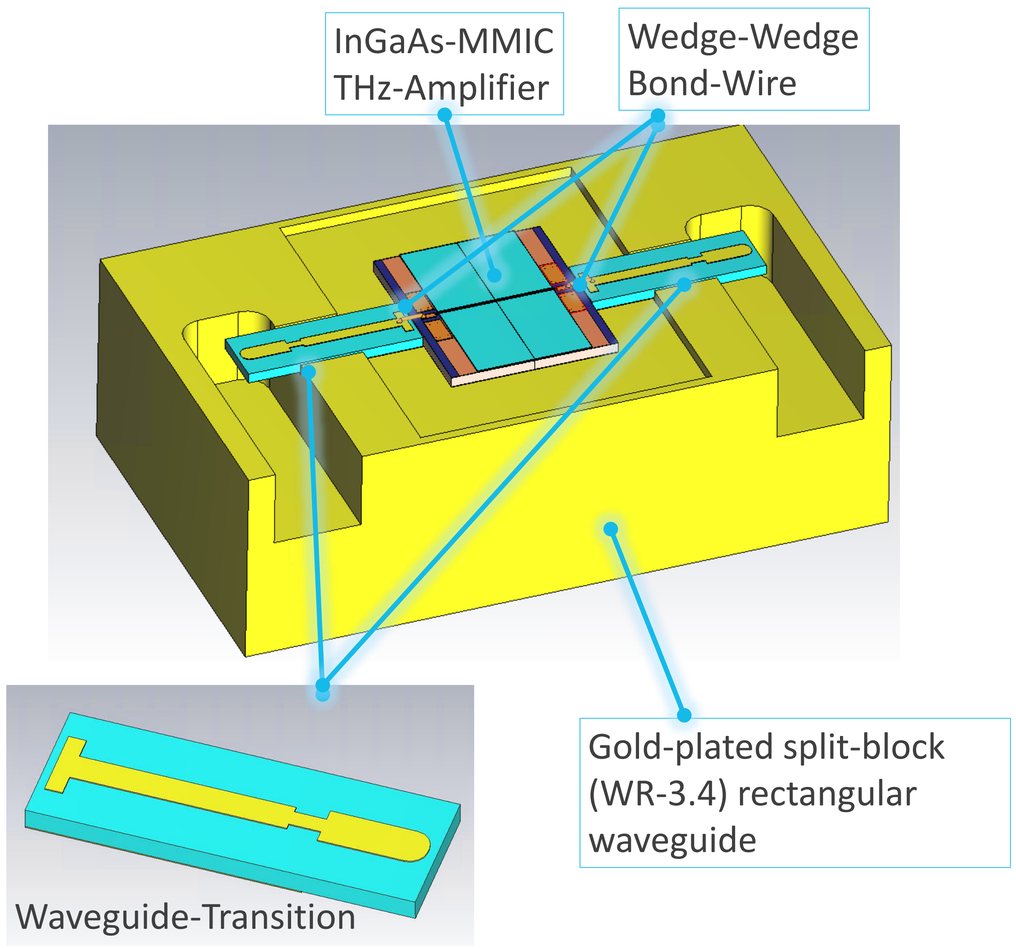
- **The goal is to develop a process that achieves:**
  - **Robust and repeatable wire-bonds**
  - **Structurability of the metal-layer-stack**
  - **Aluminum or copper as a bulk material in the metal layer-stack for low-loss signal transmission**
  - **In case of a master-thesis: Low loss of the interconnect**



Micrograph of a wedge-wedge wire-bond on a nickel-palladium thin film metal layer stack



InGaAs MMIC with transitions to WR 3.4 waveguide implemented on-chip from a recent publication



Targeted application/assembly: CAD-Model in CST-Microwave-Studio of THz packaging based on Polyimid Transitions.

Examples of possible challenges during structuring and bonding:
Left: Inhomogeneous underetching due to incompatible layers
Right: Surface with too narrow process window for wire bonding

Institut für Robuste Leistungshalbleitersysteme

IGM Institut für Grossflächige Mikroelektronik

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