HECTAS – High Energy Chrip and Transducer for the Analysis of Semiconductors

Hochenergie Chirp und Transducer für die Analyse im SEMI-Bereich

BACKGROUND

As part of a joint research project between PVA TePla Analytical Systems GmbH, Aalen University, TU Bergakademie Freiberg, and Industrial Electronic Components GmbH, a demonstrator of a novel chirp ultrasound transducer chain is being developed. The system will operate at frequencies up to 400 MHz and apply pulse compression to push the boundaries of Scanning Acoustic Microscopy (SAM) for microelectronics testing.

Conventional ultrasound microscopes use the pulse-echo principle: a short pulse is emitted, and the reflected signals are recorded and analyzed. However, with the increasing miniaturization and 3D integration in microelectronics, the requirements for inspection technologies are rising. Higher frequencies improve resolution but come at the cost of reduced acoustic energy, stronger attenuation, and thus limited penetration depth.

The project's pulse compression approach offers a promising solution: it combines high acoustic energy with improved depth resolution, enabling more precise analysis of complex, multilayered samples.

RESEARCH FOCUS

To achieve these goals, several technological advances are being pursued:

- New transmitter and receiver electronics
- Innovative ultrasound lenses with bandwidths up to 200%
- Optimization of electrical impedance matching and reduction of chromatic lens aberrations
- Advanced signal processing methods to enable efficient pulse compression and separation of signals from different sample depths

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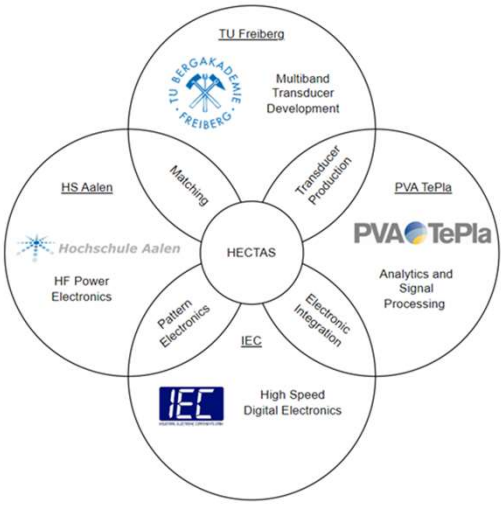
KEY STATEMENTS

New manufacturing technologies such as 3D integration and System-on-Chip demand a new generation of ultrasound lenses and electronics.

Pulse compression enables the combination of high acoustic energy, improved resolution, and increased penetration depth.

For multilayered samples, this technique significantly improves layer separation.

To fully exploit the potential of various chirp signals, enhanced signal processing is essential.



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