

Technologies



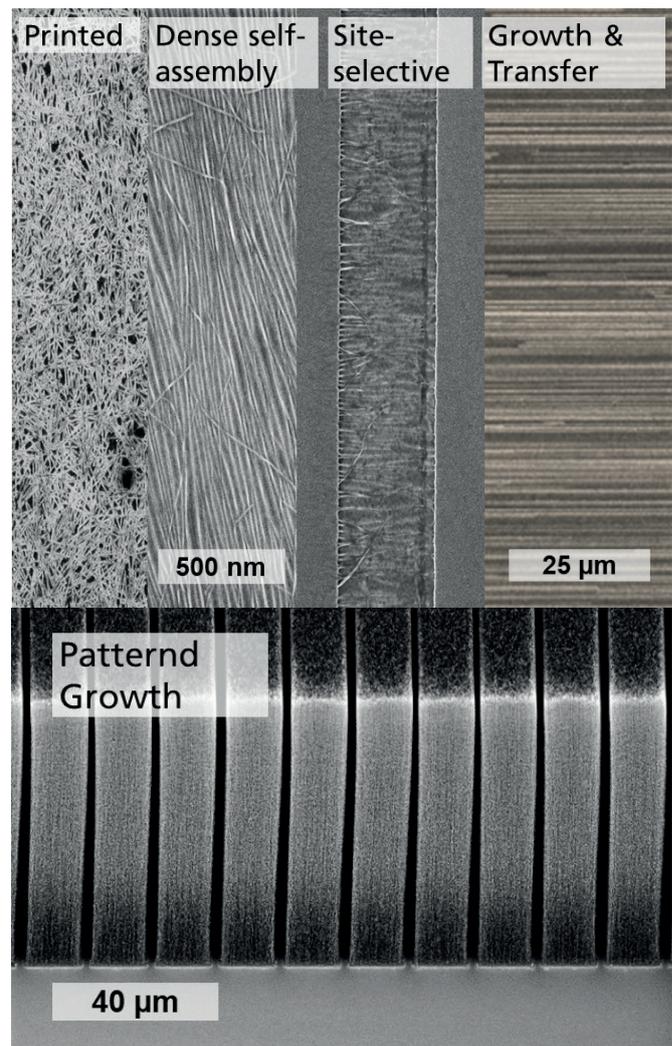
Technology Platform for Carbon Nano Devices

Fast Facts

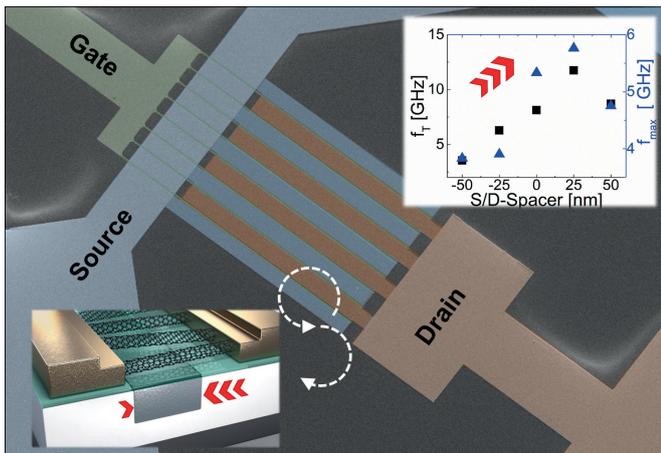
- Nanomaterial integration on 200 mm wafer-level
- CNTFET technology module
- RF-CNTFETs for applications up to 100 GHz
- CNT-based sensor arrays
- Heterogeneous technology on-top of CMOS

Carbon Nanotubes are an excellent material basis enabling added functionality, high sensitivity, high performance as well as high energy efficiency in emerging electronic or sensor concepts. At the Fraunhofer ENAS a wafer-level technology platform is available covering scalable processes for Integration of Nanomaterials, CNTFET device technology and integration into systems.

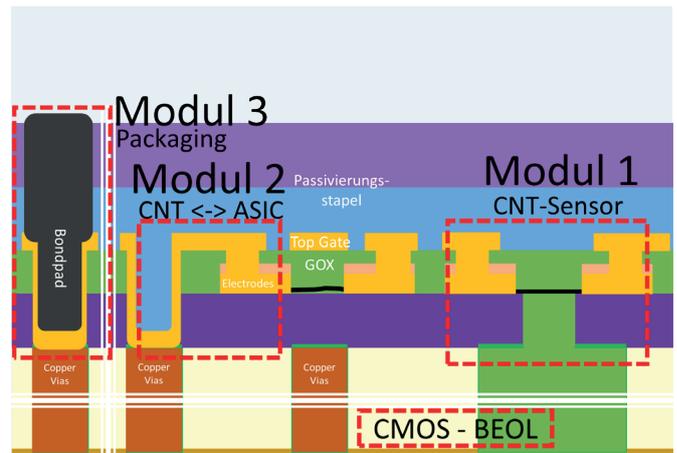
- Integration of electronic grade semiconducting CNTs
- Integration of patterned vertically aligned CNTs
- Processes development for controlled assembly with respect to density, film structure and orientation
- Scaling up of processes and compatible processes for heterogeneous integration



3D control of CNT integration on wafer-level.



Top view of 16 GHz RF-CNTFET in bottom gate configuration.



On-top of CMOS integrated CNT sensor module.

CNTFETs

Field-effect transistors are the basis for a wide range of applications. At Fraunhofer ENAS a technology module for CNTFETs was developed on wafer-level.

- Substrate-free technology for high-performance transistor functionality
- Radio frequency CNTFET for up to 100 GHz operation for emerging energy efficient transceiver electronics making use of unique 1D electronic properties and integrability
- Scalable surface technology for strain-controlled and suspended nanostructures for sensor applications
- Development of customized interfaces for sensor applications

From Device to System

CMOS compatible technology enables added value and functionality in electronic systems.

Development of technologies for:

- Condition monitoring of electronics for Prognostic Health Monitoring concepts
- Integrated Hardware Security, e.g. physical unclonable functions with high tamper evidence
- Large sensor arrays on-top of CMOS electronics for miniaturized multiparameter sensors, e.g. gas sensor, bio sensor
- Quantum computing and quantum sensing

In cooperation with



Fraunhofer ENAS is part of



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Photo acknowledgments:
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