

5. Summary

We experimentally show that the combination of novel EO materials and slot waveguide structures enables silicon-based IQ modulators with unprecedented performance. We demonstrate generation of 28 GBd QPSK and 16QAM signals, leading to data rates of 56 Gbit/s, and 112 Gbit/s, respectively. Using record-low peak-to-peak drive voltages of $U_d = 0.6$ V, we obtain error-free QPSK modulation and 16QAM signals with a BER of 5.1×10^{-5} . The drive signal is derived directly from the output of the DAC, without the need for an additional driver amplifier. For the 16QAM experiment, we estimate an energy consumption of only 19 fJ/bit — the lowest value reported so far for 16QAM signaling at 28 GBd.

Acknowledgments

We acknowledge support by the European Research Council (ERC Starting Grant ‘EnTeraPIC’, number 280145), the EU-FP7 projects PhoxTroT and BigPipes, the Alfried Krupp von Bohlen und Halbach Foundation, the Karlsruhe International Research School for Teratronics (HIRST), the Karlsruhe School of Optics and Photonics (KSOP), the DFG Center for Functional Nanostructures (CFN), the Karlsruhe Nano-Micro Facility (KNMF), the Initiative and Networking Fund of the Helmholtz Association, the Deutsche Forschungsgemeinschaft, and the Open Access Publishing Fund of Karlsruhe Institute of Technology. We further acknowledge financial support of the National Science Foundation (DMR-0905686, DMR-0120967, DMR-1303080) and the Air Force Office of Scientific Research (FA9550-09-1-0682).