

## High Performance Vertical Organic Transistors

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Organic field effect transistors (OFET) have so far not achieved major commercial impact, despite their many attractive properties such as low-cost, low-temperature processing, and flexibility. In this talk, I will discuss recent work which addresses some of the shortcomings of the OFET. One key approach is to introduce controlled electrical doping into OFET structures, allowing better injection and novel operation principles such as inversion operation.

Furthermore, I will discuss vertical transistor structures which have very short channel length without micropatterning. These structures allow much higher current densities than the lateral OFET despite rather simple processing technology. These devices are e.g. well suited to drive organic light emitting diodes (OLED), allowing all-organic flexible OLED displays. Recently, we have achieved current densities as high as  $\text{kA}/\text{cm}^2$  /1/ which will allow to use these devices for applications where higher power is required, such as bright OLED displays.

These devices have also shown record operating frequencies for organic transistors, above 40MHz /2/. They also show very interesting nonlinear properties such as negative differential resistance (NDR) due to the heating-induced improvement of mobility /3/. Recent studies prove excellent stability, sufficient for broad applications /4/

1. M. P. Klinger et al., Sci. Rep. 7, 4471 (2017)
2. B. Boroujeni et al., Sci. Rep. 8, 7643 (2018)
3. M. Klinger et al., Scient. Rep. 8, 9806 (2018)
4. F. Dollinger et al., Adv. Electron.Mater. 5, 190057 (2019)