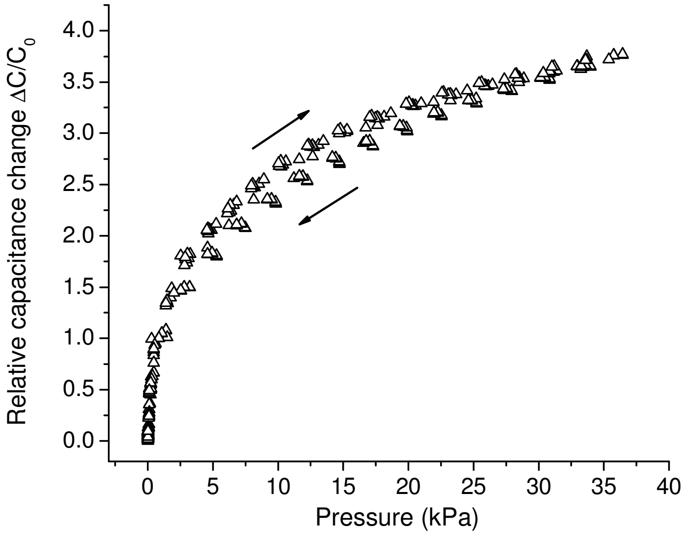
nature materials

SUPPLEMENTARY INFORMATION

DOI: 10.1038/NMAT2834

Stability and reproducibility of pressure-induced capacitance changes



Supplementary Figure S1. Pressure response curves from three consecutive linear loading-unloading cycles performed on a 6x6 µm pyramid-microstructured PDMS film at RT. The hysteresis is small and represents an upper limit of the true hysteresis because some of the shift is introduced by limitations in the measurement procedure (specifically, the limited synchronization of capacitance measurement and z-stage advancement)

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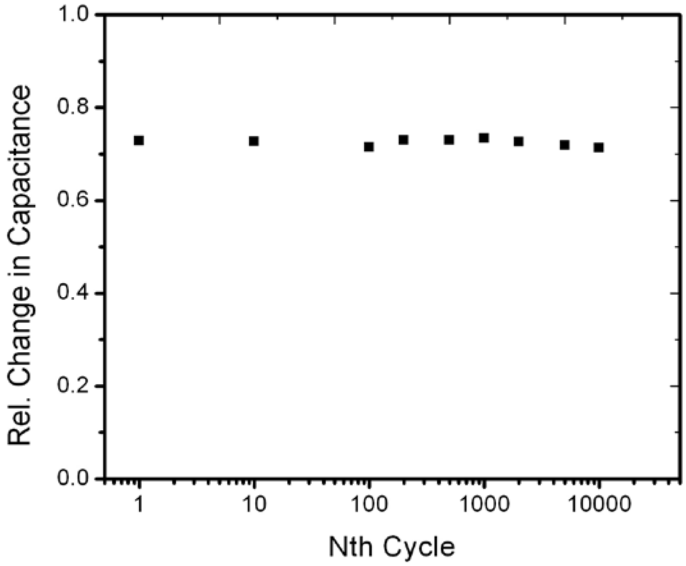
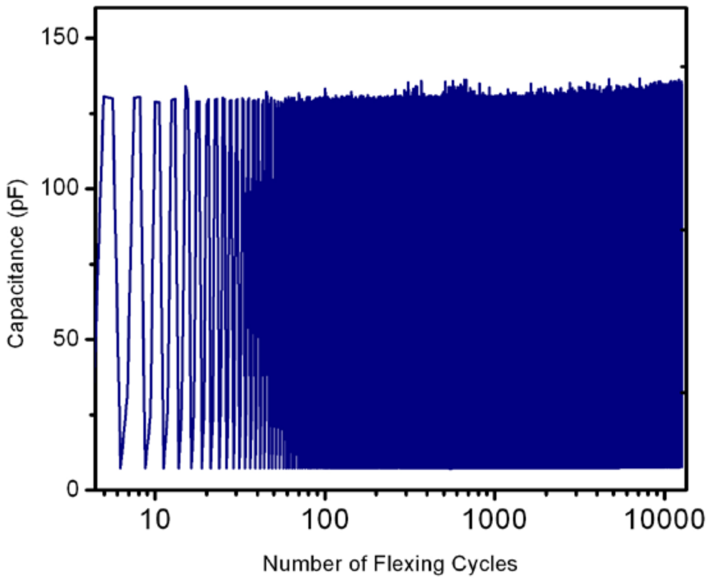
Stability of pressure response during loading/unloading cycles (flat geometry)



Supplementary Figure S2. Stability of pressure response to a load of 1.5kPa over 10,000 cycles on a flat surface. The sensor device contained a 5µm x 5µm pyramid micro-structured PDMS film sandwiched between two polycarbonate substrates with aluminium electrodes. The normalized relative capacitance change is measured after the completion of each Nth cycle. The very small signal drift documents a high stability of the response throughout the 10,000 cycles.

Electro-mechanical stability of pressure sensors



Supplementary Figure S3. Electro-mechanical stability of pressure sensors (5µm x 5µm pyramid micro-structured PDMS films on polycarbonate-based bottom terminal and a very thin PDMS-based top electrode). One end was kept fixed while the other end was connected to a stepper motor that flexed the film to a positive radius of curvature of 4mm and back to the unbent state continuously. The sensors endured > 15 000 bending cycles at bending frequency of ~ 1 Hz without any sign of delamination or signal degradation, suggesting an excellent electro-mechanical stability of the device over the cycles. No damage of the structured dielectric was observed, and the baseline capacitance shows no appreciable drift over time.

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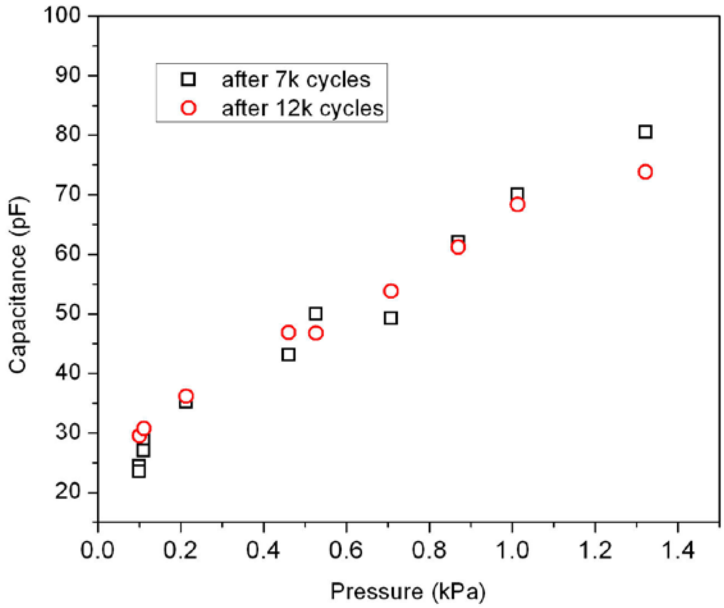
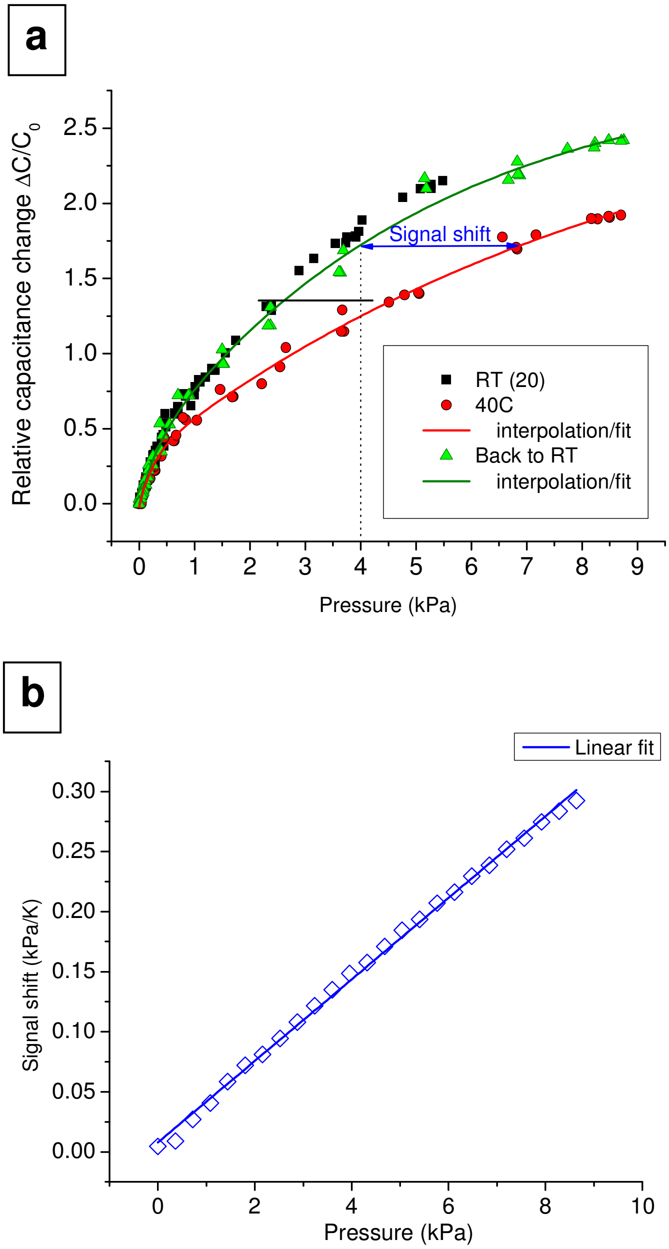
Stability of pressure response after repeated bending of the device



Supplementary Figure S4. Stability of response curve during repeated bending cycles (5µm x 5µm pyramid micro-structured PDMS film on polycarbonate-based bottom electrode/substrate with a very thin PDMS-based top electrode). Two sensor pressure response curves were measured after 7000th and 12000th bending cycle to 4mm radius of curvature. The curves were obtained by the application of various weights placed directly on the sensor area. The device shows no appreciable degradation in response to application of pressure despite bending it continuously as many as 12,000 cycles. The small amount of noise in these curves (compared to the ones measured with the motorized stage) have to be attributed to the set-up of the sample in the bending stage which required the placement of discrete weights by hand in order to apply defined pressure loads.

Temperature dependence of sensor response



Supplementary Figure S5. a, Loading unloading cycles recorded at RT and elevated temperature (40C). The relative capacitance change decreases most likely as a result of the thermal expansion of the micro-structured PDMS film (C is inversely proportional to film thickness). **b**, The signal shift at a given temperature varies linearly with the applied pressure (0.3kPa/K at 9kPa, relative signal shift: 3% per Kelvin) which should allow for easy correction when the temperature is measured simultaneously.

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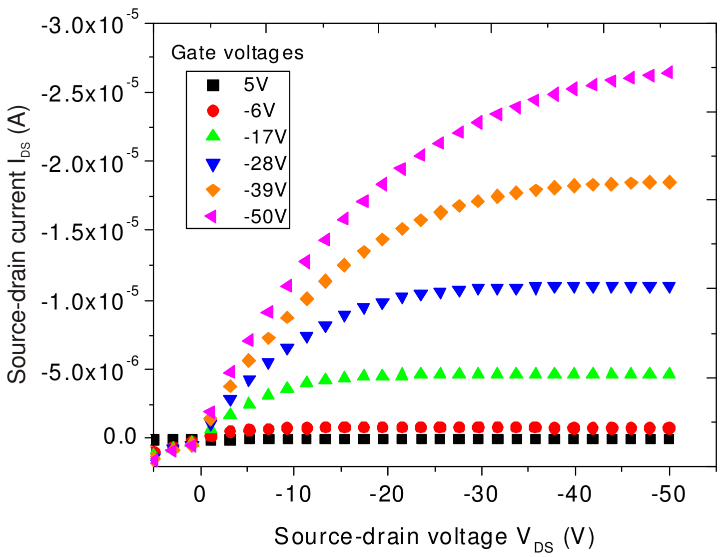
Electrical performance of the rubrene single crystals



Supplementary Figure S6. Output characteristics of the rubrene single crystals, measured with the SiO2 bottom gate. The mobility of these crystals is typically on the order of 1 (here 0.8 cm^2/Vs, W/L = 10).

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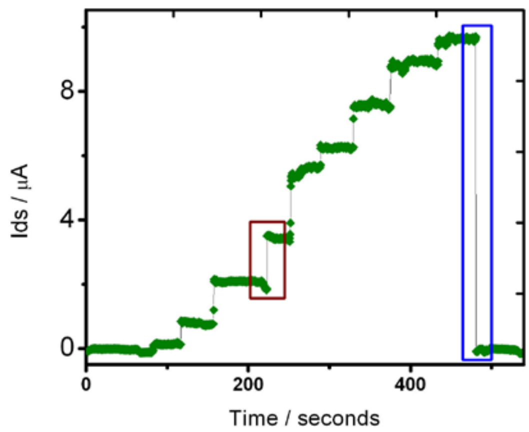
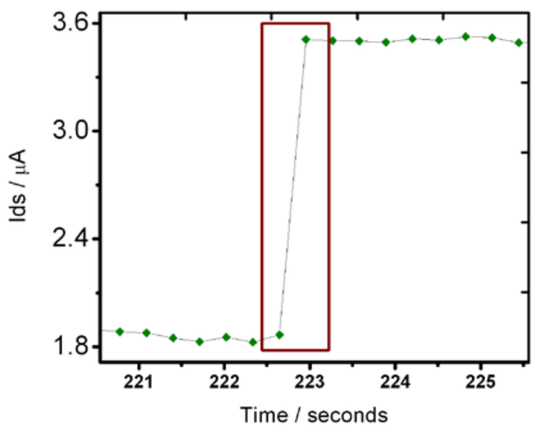
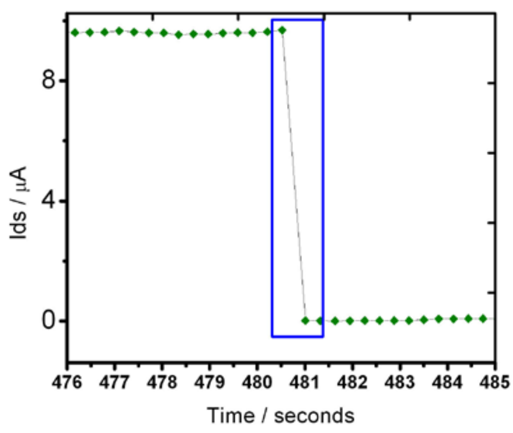
Pressure response of rubrene-OFET based sensors







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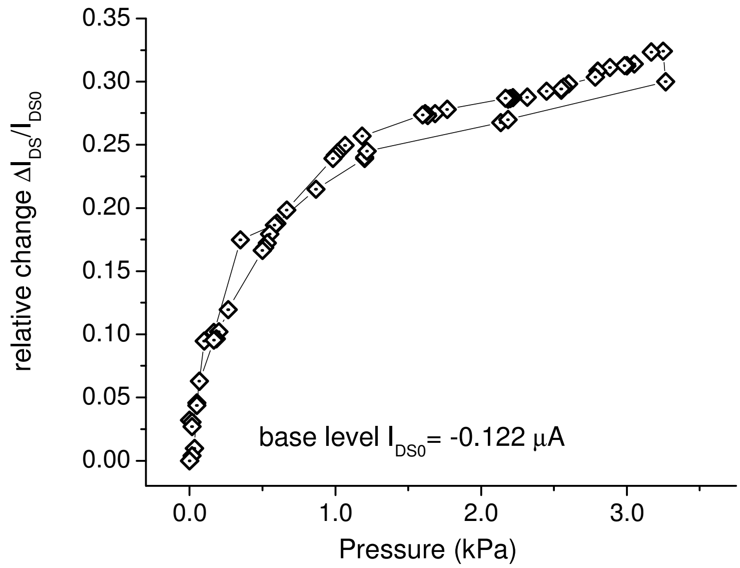
Supplementary Figure S7. Time response of OFET sensors to application and removal of external pressure loads. These devices show a similarly rapid response as capacitance-based sensors. a) OFET was subjected to step-like increase in pressures. b) An increase in pressure with a response time of less than 300ms. c) A decrease in pressure from large load to zero load within less than 500 ms.

Rubrene-OFET pressure sensor at reduced bias voltages



Supplementary Figure S8. Pressure-response curve of a rubrene single crystal OFET pressure sensor, operated at V_{DS}=V_G=-20V. The device can stably sense static pressure loads displaying only very small hysteresis. I_{DS0} refers to the source-drain current without pressure load.

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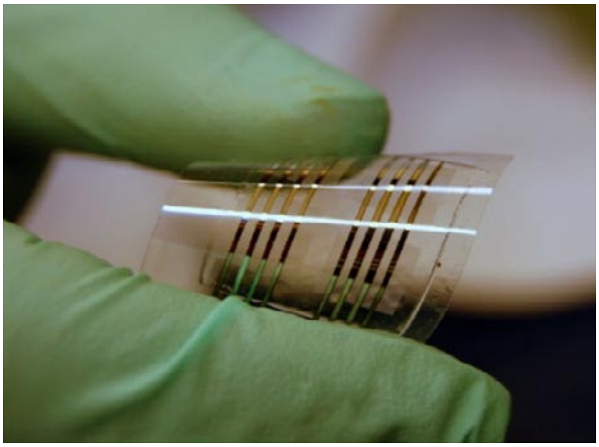
Matrix-type capacitive pressure sensor



Supplementary Figure S9. Photograph of the PET film with micro-structured PDMS on aluminum metal lines. Another layer of PET with same metal line patterns was subsequently placed orthogonally to the PET film with micro-structured PDMS for pressure sensor testing.