Visualizing Charge Transport in Organic Electrochemical Transistors

Electrochemical Strain Wave Microscopy with Park NX10

The Challenge

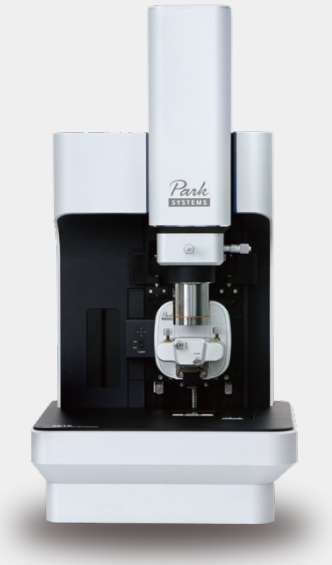
"Understanding charge transport in OECTs required us to look beyond macroscopic electrical measurements and investigate how transport processes vary locally across the device channel. We needed an approach capable of connecting microscopic structure with functional transport behavior under operating conditions."

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

— Prof. Tobias Cramer
Department of Physics and Astronomy

Your Challenge, **Our Solution**

Park NX10



This case study is based on University of Bologna research on electrochemical strain wave microscopy and related peer-reviewed research published in Small.

Park SYSTEMS

Park NX10
Customer Success Story

ALMA MATER STUDIORUM
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The Solution

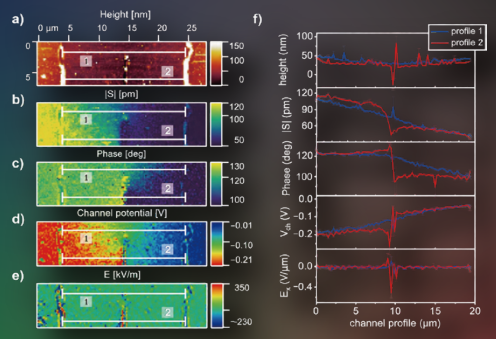
PinPoint-Based Multichannel Imaging
Acquires multichannel images of OECT channels using Park NX10 in PinPoint mode

Amplitude and Phase Mapping
Uses lock-in detection to map local swelling amplitude and phase through the NX10 auxiliary input channels

In-Operando Transport Characterization
Maps strain-wave propagation across n-type and p-type OECTs to investigate local transport behavior

Electrochemical Strain Wave Detection
Applies modulated electrical excitation to detect strain waves associated with charge transport and swelling in the OMIEC channel

Electrochemical strain wave microscopy reveals local transport variations and microscopic defects in operating OECTs.



Related Publication
Small 21, e10345 (2025) DOI: 10.1002/smll.202510345

The Results

Local Transport Mapping
Mapped electrochemical strain-wave amplitude and phase across operating OECT channels

Microscopic Transport Defects
Revealed microscopic defects associated with local charge-transport bottlenecks

Carrier Mobility Characterization
Determined carrier-concentration-dependent mobility behavior in n-type and p-type devices

Structure–Function Correlation
Connected OECT microstructure with functional transport behavior below the diffraction limit

"Park NX10 provided the flexibility needed to implement electrochemical strain wave microscopy and investigate local transport processes in operating OECTs. This allowed us to connect microscopic device structure with functional charge-transport behavior."

— Prof. Tobias Cramer

