Kelvin probe force microscopy (KPFM) maps electrostatic potential at sample surfaces to provide information about electronic structure, doping level variations, trapped charges, and chemical identity in applications ranging from organic photovoltaics research to silicon and wide bandgap semiconductor characterization. Bruker’s PeakForce KPFM™ module for Dimension Icon® and MultiMode® 8 Atomic Force Microscopes (AFMs) utilizes exclusive PeakForce Tapping™ technology to take this method to the next stage, enabling quantitative work function mapping at top spatial resolution with higher sensitivity and immunity to artifacts from mechanical crosstalk.

**The Complete KPFM Solution**
- Most accurate, repeatable, and sensitive work function measurements
- Leading-edge spatial resolution combined with artifact-free potential contrast
- Correlated quantitative nanomechanical property mapping
- ScanAsyst® ease of use and optimized results
Limitations of Conventional Approaches

In principle, KPFM can provide a quantitative measure of the work function difference between sample surfaces and AFM tips. In practice, when interrogating relevant samples (i.e., nanoscale structures with variations in modulus or adhesion), conventional ambient, TappingMode™-based KPFM approaches face severe limitations. This is true for both the commonly used detection mechanisms of amplitude modulation (AM) and frequency modulation (FM). Where AM detection suffers from a lack of spatial resolution due to the whole cantilever’s contribution to the error signal, FM is subject to mechanical cross-talk and lack of sensitivity. This mechanical cross-talk originates from the fact that nanomechanical tip-sample interactions shift the cantilever resonance behavior and thus affect sideband detection employed in FM. Sensitivity limitations stem from the need for high-k (for stable oscillation), low-Q (for tapping response bandwidth) cantilevers for TappingMode, the exact opposite of what maximizes KPFM sensitivity. Furthermore, parameter setup complexity in conventional KPFM can limit user-to-user consistency.

The Breakthrough

PeakForce KPFM takes full advantage of the high spatial resolution afforded by FM KPFM while avoiding its pitfalls. By employing Bruker’s patented LiftMode™, it avoids mechanical crosstalk. By building on the suite of PeakForce Tapping technology, it aligns cantilever needs, providing highest resolution topography with the same low-k, high-Q cantilevers, maximizing potential sensitivity. In these ways, PeakForce KPFM can resolve and quantify nanoscale work function variations that are extremely challenging for TappingMode. In addition, PeakForce QNM® provides directly correlated quantitative nanomechanical information.

Bruker’s Solution

With the new PeakForce KPFM mode, Bruker offers consistent and quantitative work function measurements at the highest spatial resolution. Aside from its signature mode, the PeakForce KPFM package also includes all industry standard KPFM implementations and an additional high-voltage mode, extending the usually accessible potential range by more than a factor of 10. Across the board, automatic setup with ScanAsyst guarantees consistently optimized results even for the non-expert AFM user. Whether imaging potential variations in complex materials, interrogating electronic structure in semiconductor samples or utilizing work function variations to map chemical distributions, the unparalleled capabilities of PeakForce KPFM will allow you to measure more accurately and learn much more about your samples.