

Quantitative characterization of biomaterials and their interaction with living cells by AFM

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Topography, roughness and mechanical properties of biomaterials are crucial parameters influencing cell adhesion/motility, morphology and mechanics as well as the development of stem/progenitor cells. Atomic force microscopy is a powerful tool not only to study the morphology in terms of high resolution imaging and roughness measurements, but also to map mechanical and adhesive properties of the sample/cells in high resolution. Combining these remarkable abilities with advanced optical microscopy allows for extensive characterization of biomaterials. The JPK NanoWizard® 3 AFM provides advanced imaging and mapping modes, which can be combined with inverted as well as upright optical microscope techniques. Using single cell force spectroscopy (SCFC), cell adhesion can be quantified, and the contribution of different components e.g. from the extra cellular matrix, can be assessed. Additionally, based on scanning force microscopy the nano-indentation technique has emerged as a useful tool to determine elastic properties like the Young's modulus for biological samples. Nano-mechanical analysis of cells increasingly gains in importance in different fields in cell biology like cancer research and developmental biology. We present a strategy to comprehensively characterize biomaterials as well as their interaction with cells and influence on cell behaviour.