Combining colloidal probe force spectroscopy & microinterferometry - A novel approach to study mechanical properties of soft solvated films

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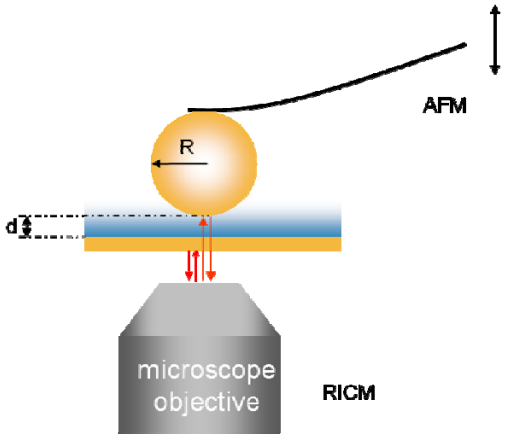

At the interface of cells adhering to an inorganic surface or to another cell, the first interaction is mediated by a micrometer thick pericellular coat [1]. Hyaluronan (HA), a simple and long linear charged biopolymer, is known to play a major role in the structure of these coats. The potential of HA and HA-binding proteins to form entangled or cross-linked networks means that the HA-dependent matrix may itself contribute to whole tissue material properties providing swelling pressure to the local matrix, tissue compression and mediating signals due to tension and shear. Hyaluronan assemblies may thus form the basis of a dynamic network through which cells may communicate and respond to external forces [2].

Atomic force microscopy (AFM) in force spectroscopy (FS) mode is a widely used analytical approach to determine the behavior of a molecule or thin films under mechanical force. Colloidal probe reflection interference contrast microscopy (RICM) is an established microinterferometric technique to determine the thickness of soft hydrated films [3]. In this study we combine colloidal probe FS and RICM. The combination provides interaction forces as a function of the *absolute* distance (d) between the two approaching surfaces (see figure), information that may not easily be obtained with either technique alone. We employ this setup to quantify the thickness of end-grafted HA films, and their resistance to compression forces as a function of salt concentration. We find a swelling behavior that is consistent with expectations for a polyelectrolyte brush. The combined (AFM/RICM) setup can serve as a powerful tool to quantify the mechanical properties of soft hydrated biopolymer films with precise control of probe sample separation.

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