



Granular Matter at the Single Particle Level

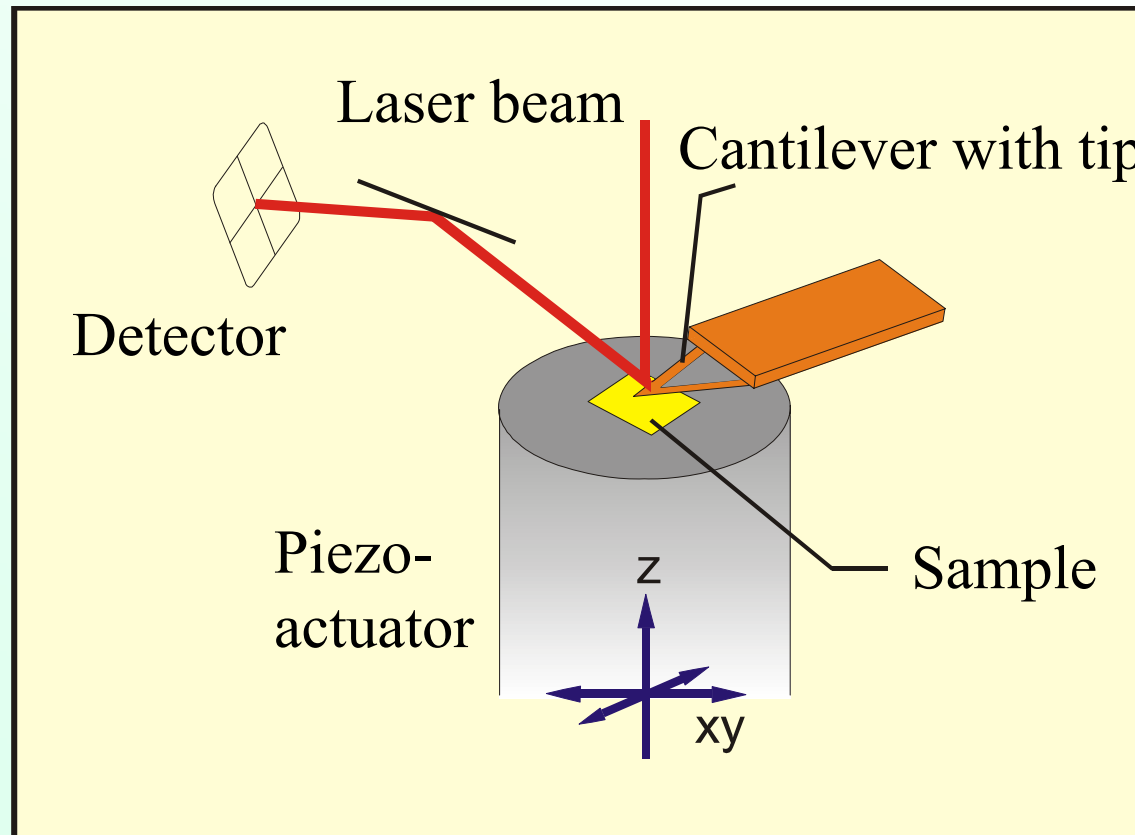


Michael Kappl
MPI for Polymer Research, Mainz



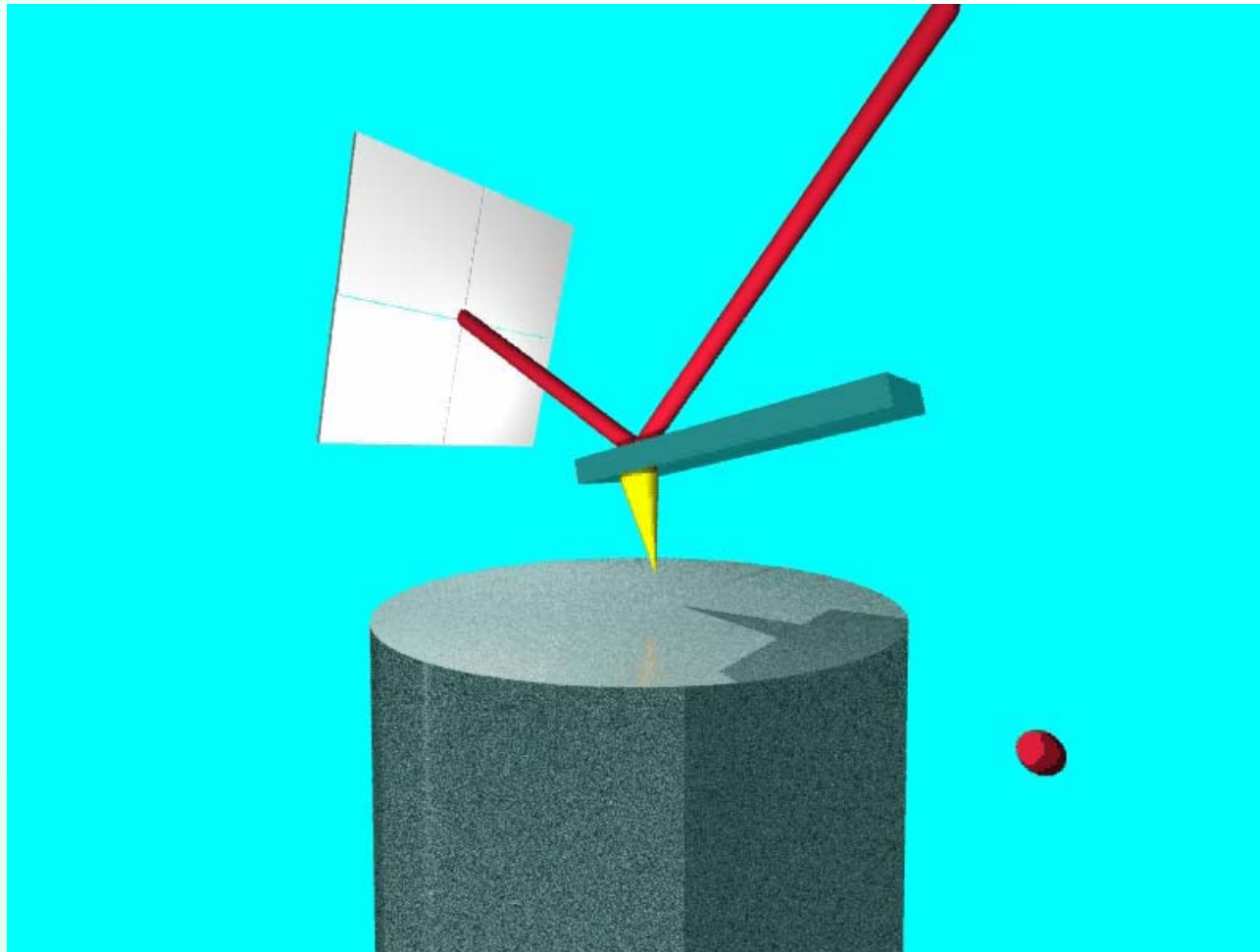


Atomic Force Microscopy



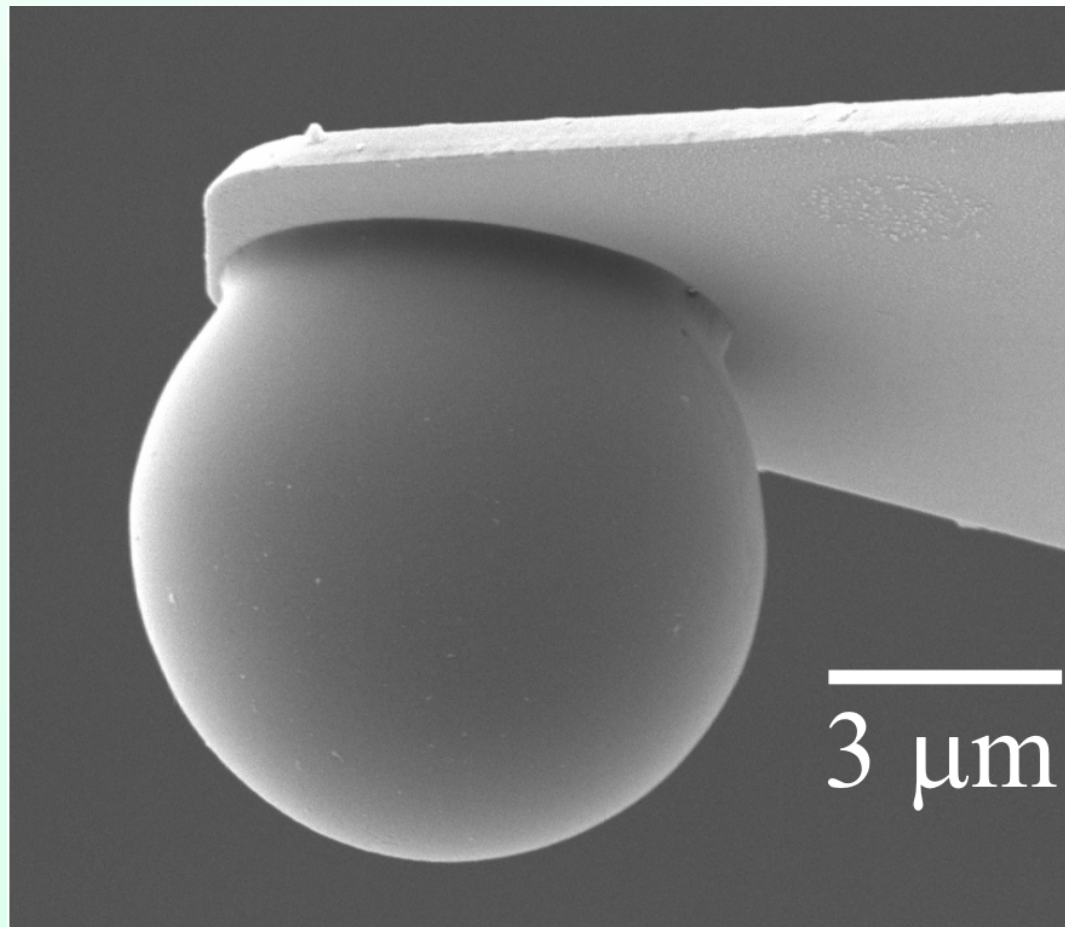


Force Distance Curves





Colloid Probe Technique



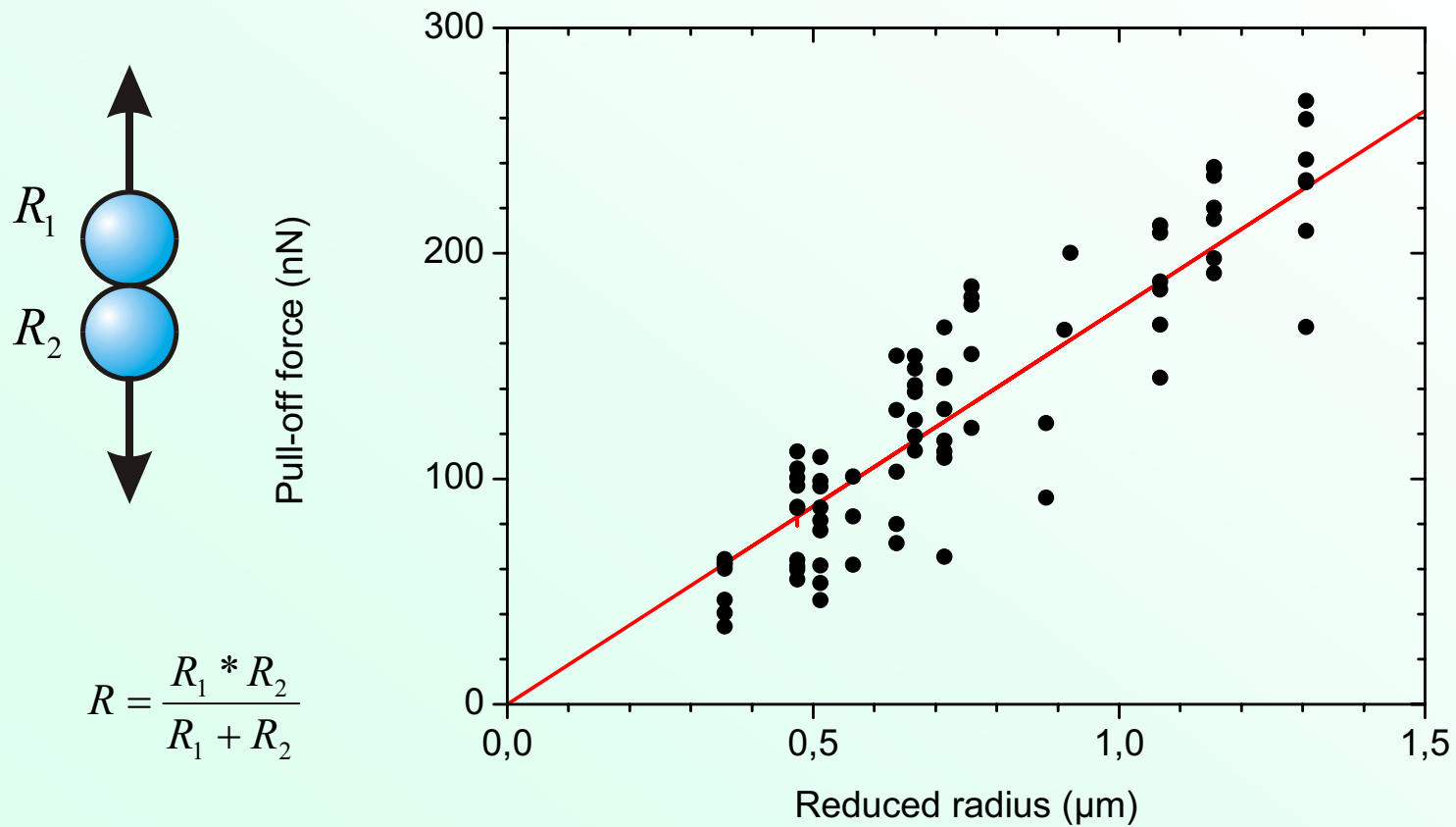


Colloid Probe Technique



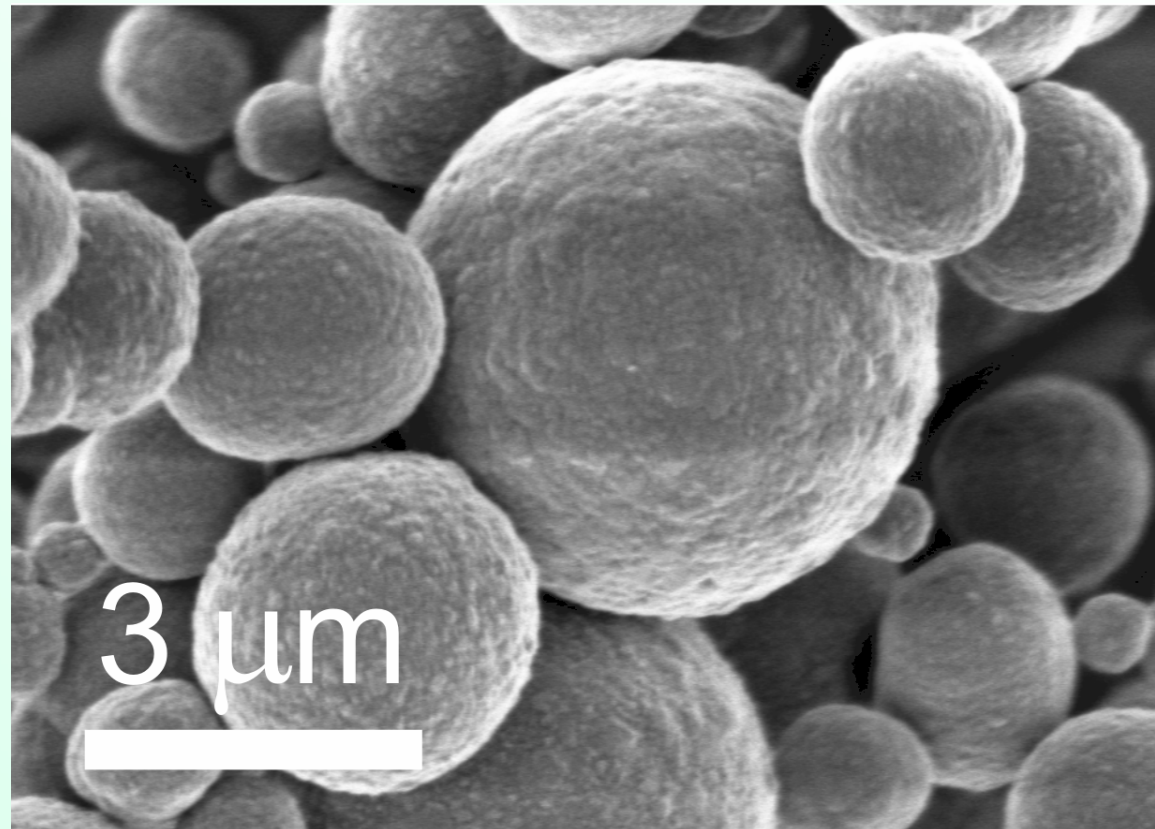


Adhesion between individual silica particles



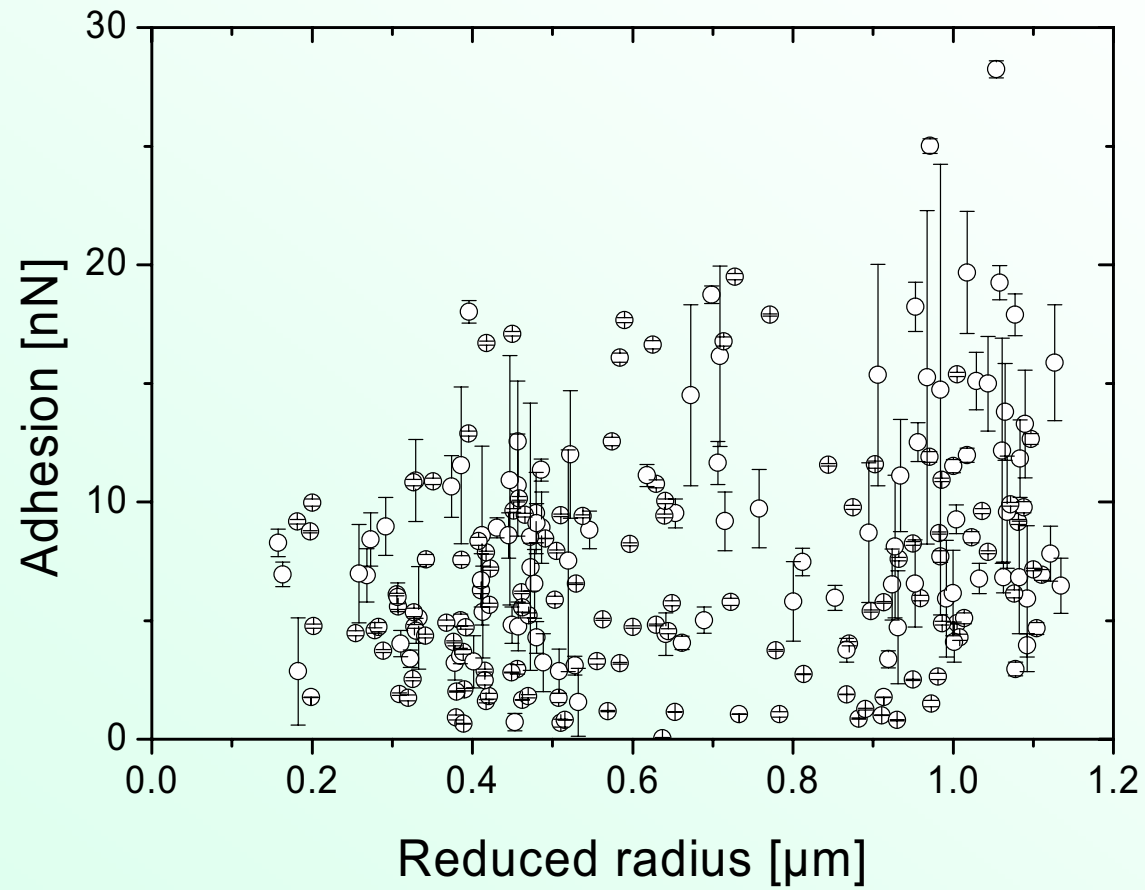
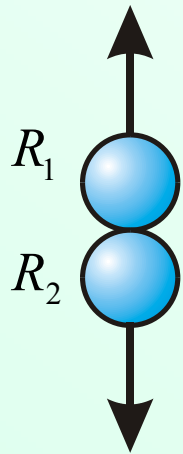


Carbonyl Iron Powder (CIP) Particles



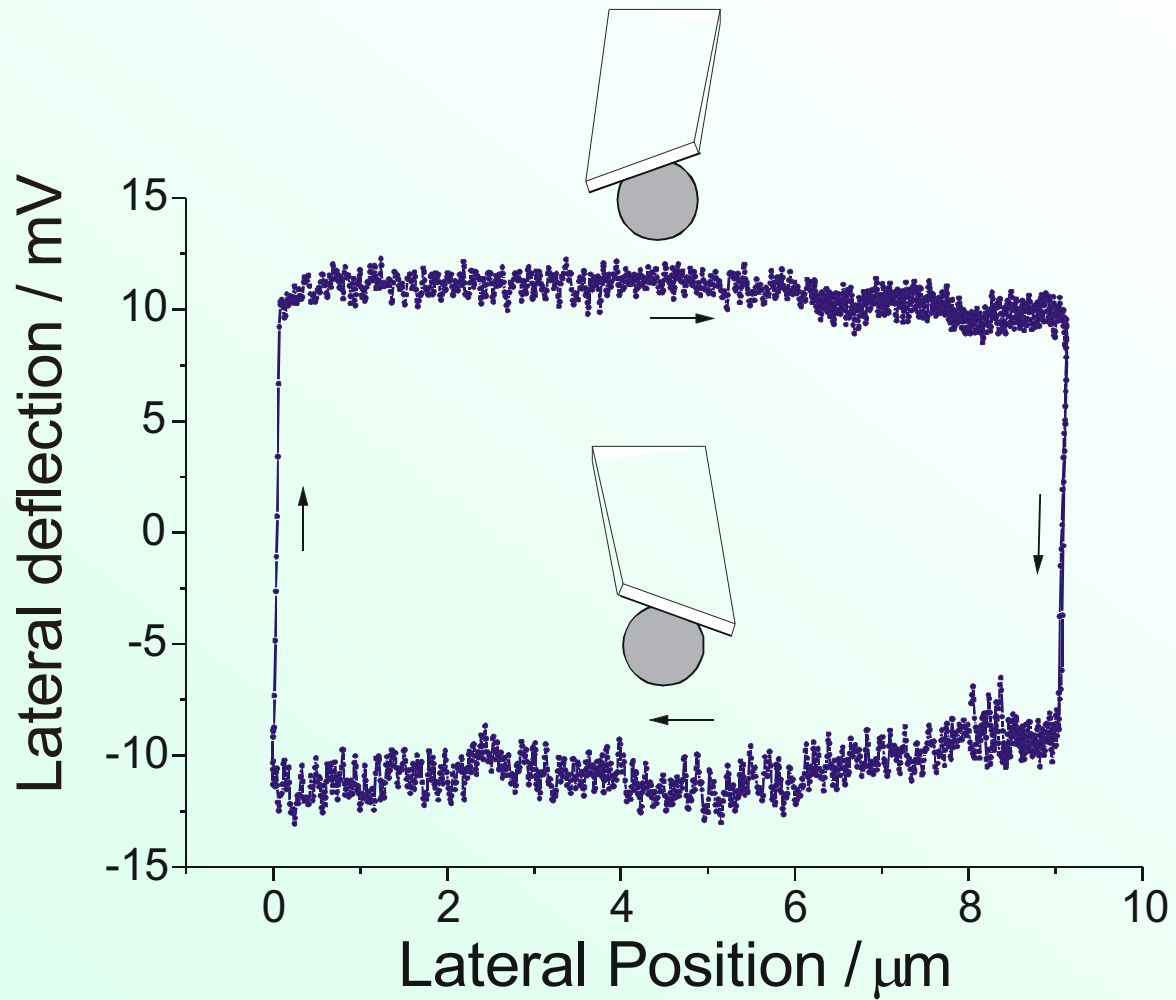


Adhesion between CIP Particles





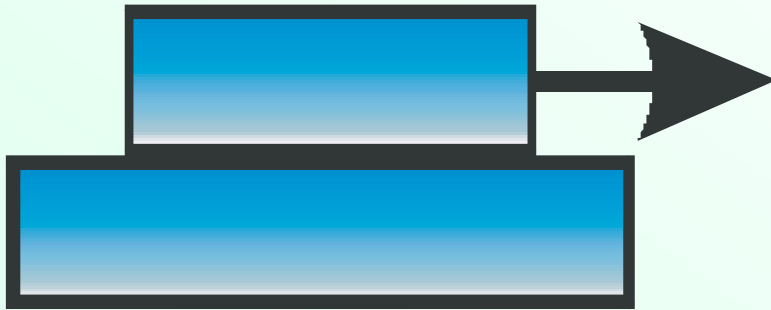
Friction force microscopy





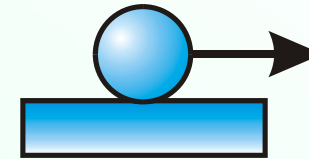
Friction between individual microcontacts

Macroscopic friction



$$F = \mu \cdot F_N$$

Microscopic friction

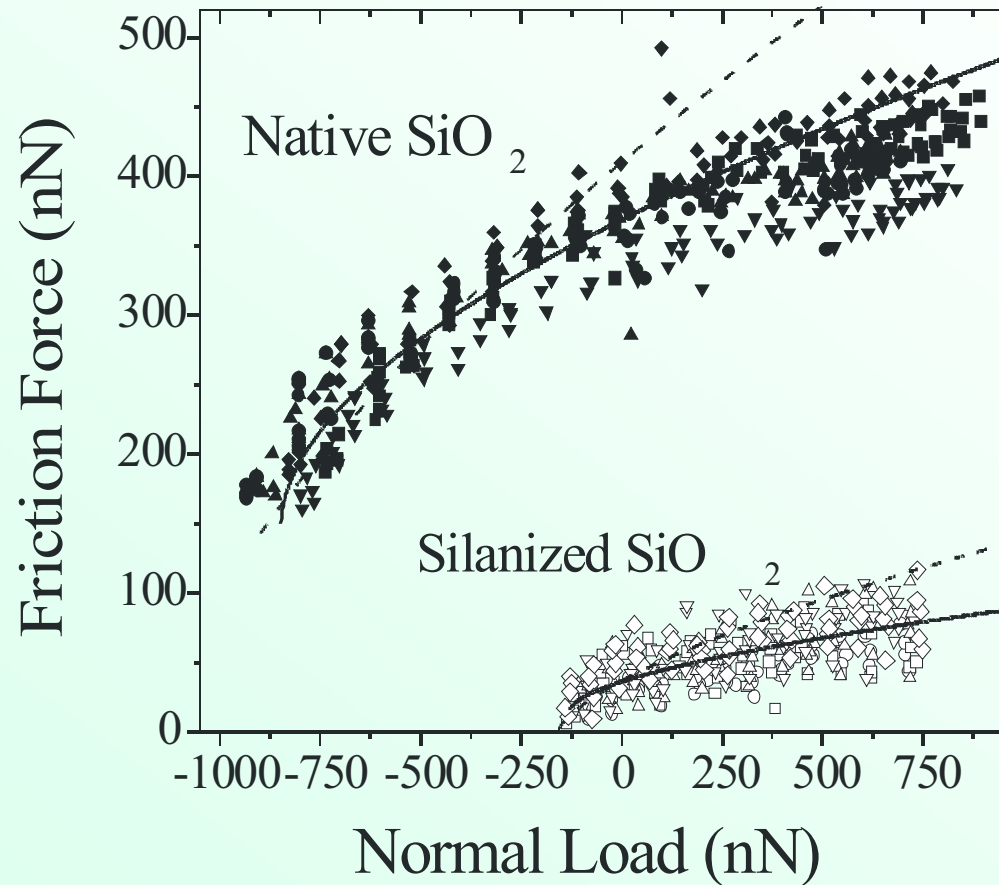
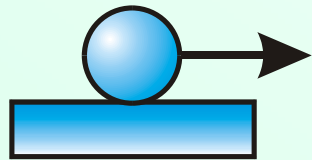


$$F = \tau \cdot A$$



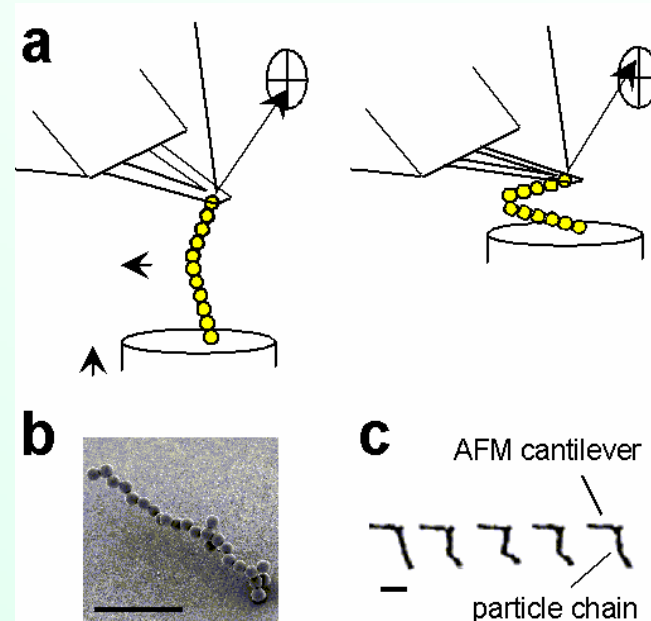
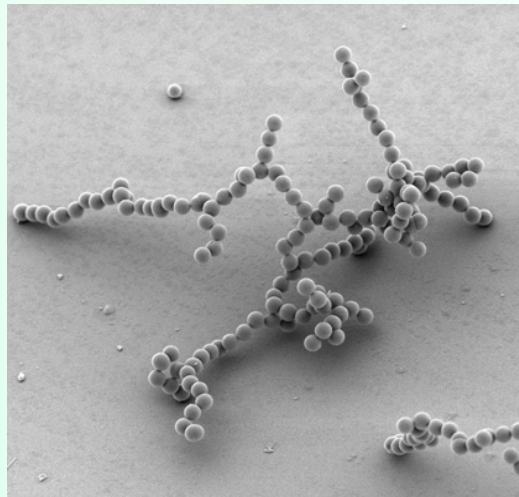
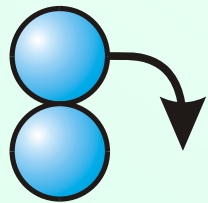


Friction of single microcontacts





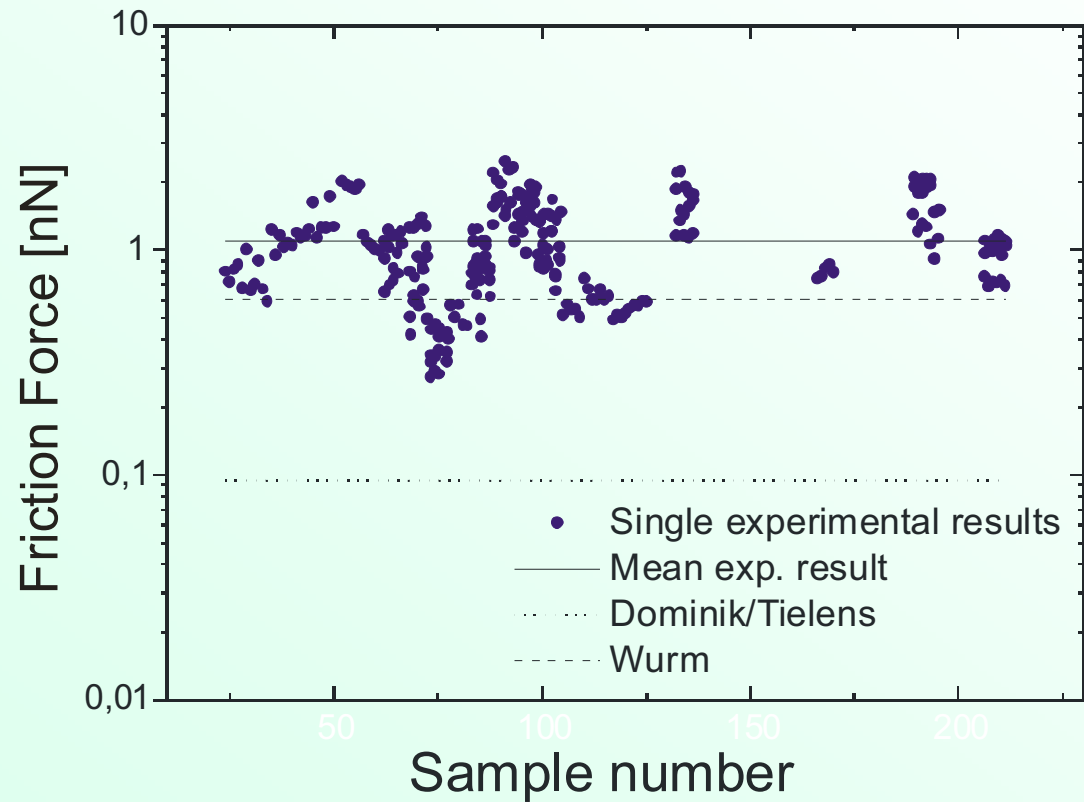
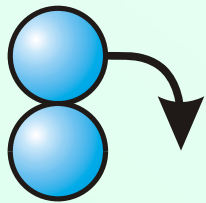
Rolling friction between silica microspheres





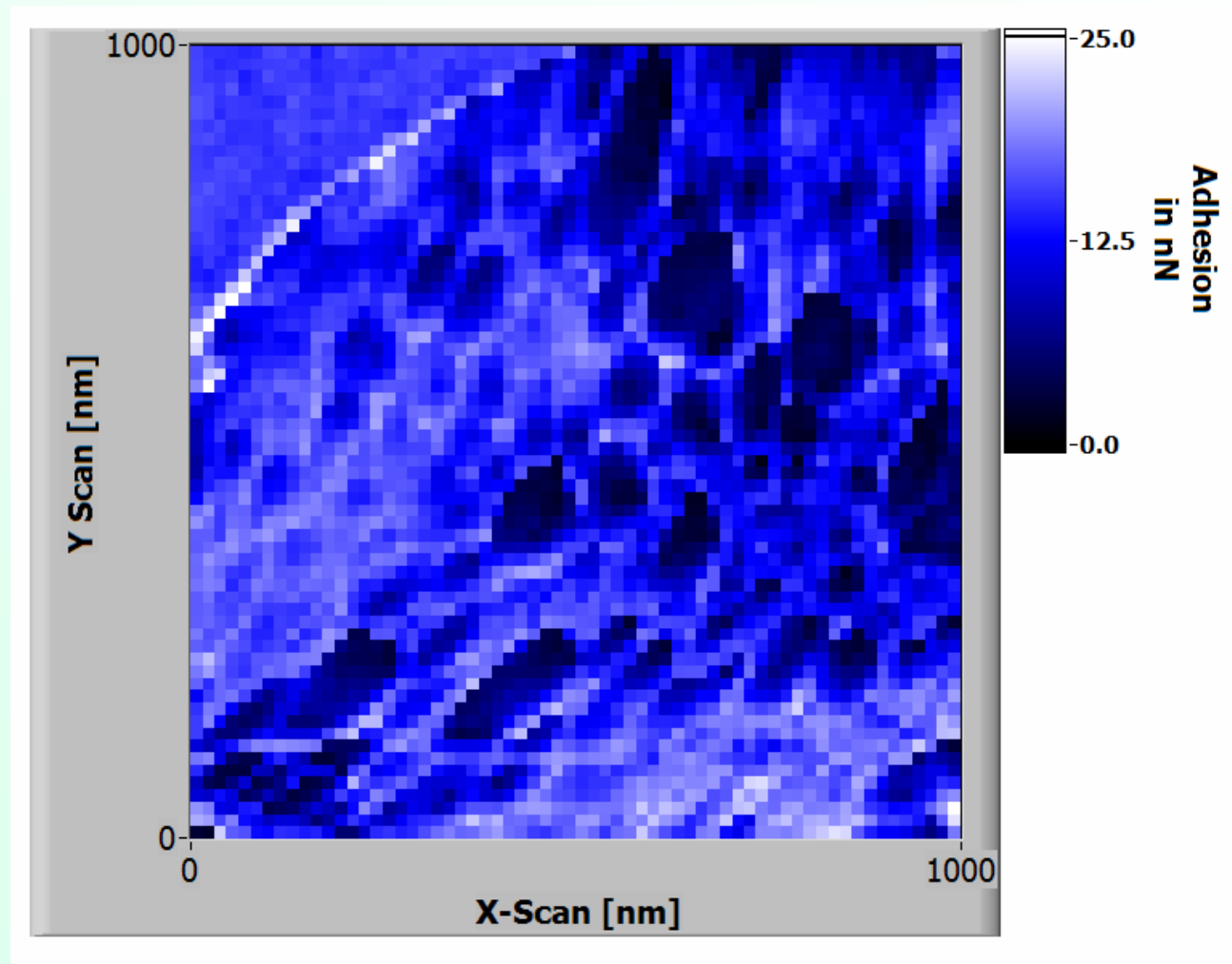
Rolling friction between silica spheres

$$F_R = 6\pi\gamma\xi \quad (\text{Dominik/Tielens})$$



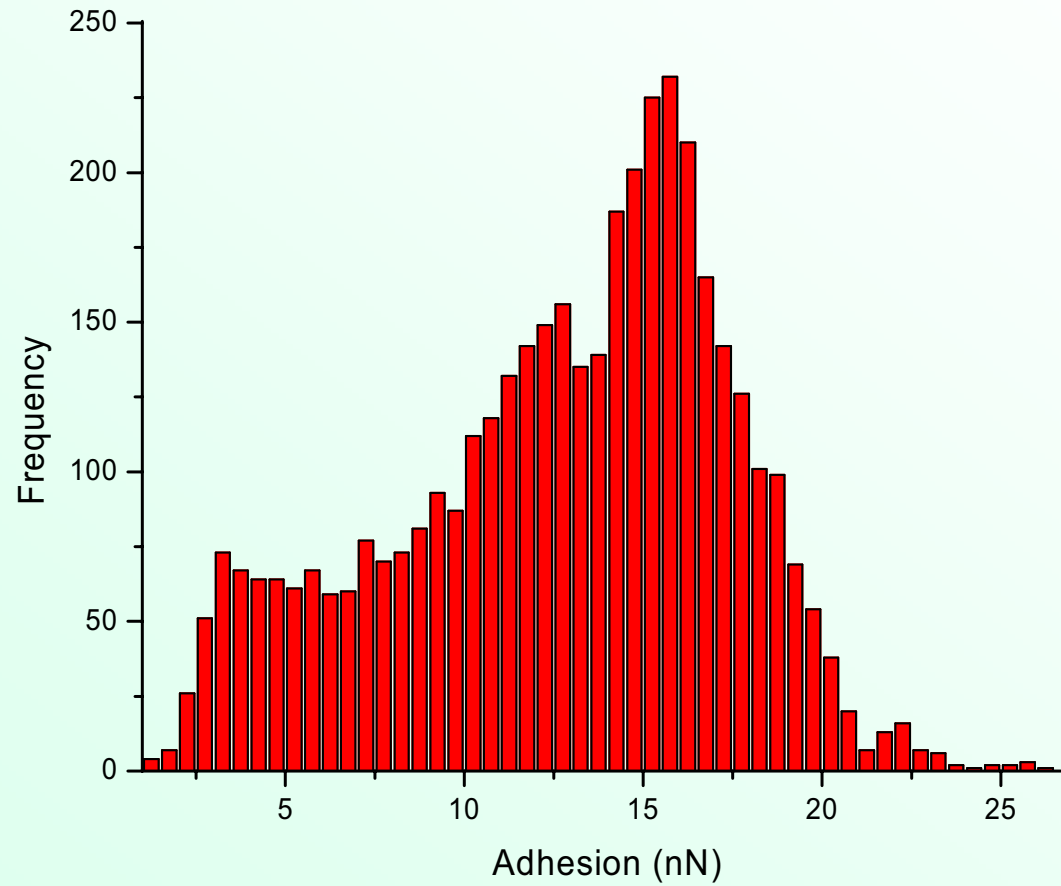


Adhesion Map Particle / Particle





Adhesion Distribution Particle / Particle





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