

SUPPLEMENTARY MATERIAL

Calculation of micro elastic moduli from optical tweezers microbead displacement data

Calculation of the mean squared displacement (msd)

To calculate the msd from the particle trajectories, the x- and y-positions were used. In experiments with a low number of tracked trajectories, a time averaging is common to improve the statistics and is given by¹:

$$msd(\tau) = \frac{1}{N} \sum_{i=1}^{N-k} (\vec{r}_{i+k} - \vec{r}_i)^2, \quad k = 1, \dots, N-1 \quad (1)$$

Here, $\vec{r}(x, y, z)$ is the particle-position and N is the number of time-steps.

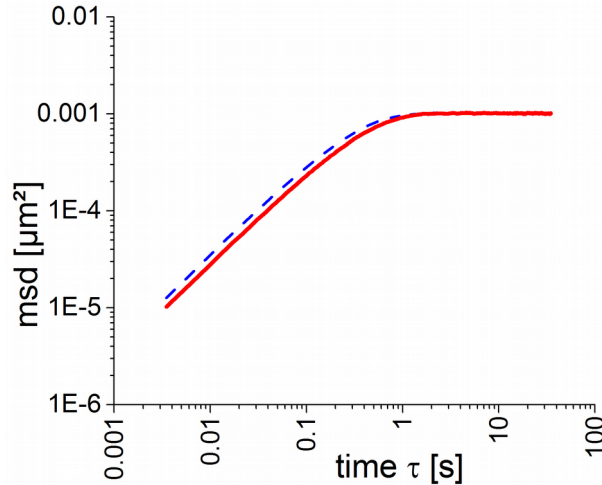


Figure S1: msd(τ) of two different trajectories (blue dashed and red solid line)

Calculation of the micro elastic modulus G'

The elastic modulus G' of the mucus in the micro scale has been calculated by using the msd at 1 sec, given by²:

$$G' = \frac{2k_B T}{msd(\tau)d} \quad (2)$$

Here, k_B is the Boltzmann-constant, T is the absolute Temperature and d is the particle-diameter.

REFERENCES

1. Michalet, X. Mean Square Displacement Analysis of Single-Particle Trajectories with Localization Error: Brownian Motion in Isotropic Medium. *Physical Review E: Statistical, Nonlinear, and Soft Matter Physics* 82 (041914), 1-26 (2010)
2. Köster, S., Lin, Y.-C., Herrmann, H. & Weitz, D. a. Nanomechanics of vimentin intermediate filament networks. *Soft Matter* **6**, 1910 (2010).