Supporting Information

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SI Text

Force-Indentation Curves Between Two Actin-Covered Beads. The force distance curves measured between two magnetic colloids covered with an actin gel show a linear increase of indentation with the force. This behavior is characteristic of an area of contact that evolves slightly during deformation. We interpret this result as a consequence of the interpenetration of the two opposite networks (Fig. S1).

Deviation of the Fit at Large Bead Separation. Due to spherical contact, a small volume is probed at small deformations. At an indentation of 20 nm, the gel is probed down to a depth of 140 nm [$a = (\delta R)^{0.5}$]. This translates as up to one or two mesh sizes of the gel (60 nm estimated from [actin] = 0.17 μM). The gel is therefore not homogenous at these scales and deformations, which explains the fit deviation from the Hertz model at large bead separation. Additionally, the presence of lone actin filaments that polymerize out of the shell would induce a steric repulsion before the strength of the magnetic attraction is enough to contact the spherical shell with the neighboring bead. Such filaments are visible on growing comets (1) especially at low gelsolin when less capping occurs.

Imposed Limit on Deformation. To ensure that the area of contact can be determined with the Hertz model even in presence of nonlinearity, we check that $a/R < 0.4$ with $a = (R\delta)^{1/2}$ the radius of the contact zone (2). The quantity a/R is related to the strain in the sample, and an average strain of 0.2 a/R is suggested for comparison with indentations experiments in nonspherical geometry (2). The maximum strain in the sample is located at the center of the contact zone and is $\varepsilon_{max} = 4a/\pi R$ (3). The limit we set on a/R translates to $\varepsilon_{max} = 0.5$. We applied the same limit for the maximum strain due to finite thickness: $\delta/h < 0.5$. Both these criteria were validated in 80% of the curves at lowest gelsolin, 85% at lowest Arp2/3, and more than 98% in all other cases.

1. Wiesner S, et al. (2003) A biomimetic motility assay provides insight into the mechanism of actin-based motility. *J Cell Biol* 160:387–398.
2. Lin DC, Shreiber DI, Dimitriadis EK, Horkay F (2009) Spherical indentation of soft matter beyond the Hertzian regime: Numerical and experimental validation of hyperelastic models. *Biomech Model Mechanobiol* 8:345–58.
3. Dimitriadis EK, Horkay F, Maresca J, Kachar B, Chadwick RS (2002) Determination of elastic moduli of thin layers of soft material using the atomic force microscope. *Biophys J* 82:2798–2810.

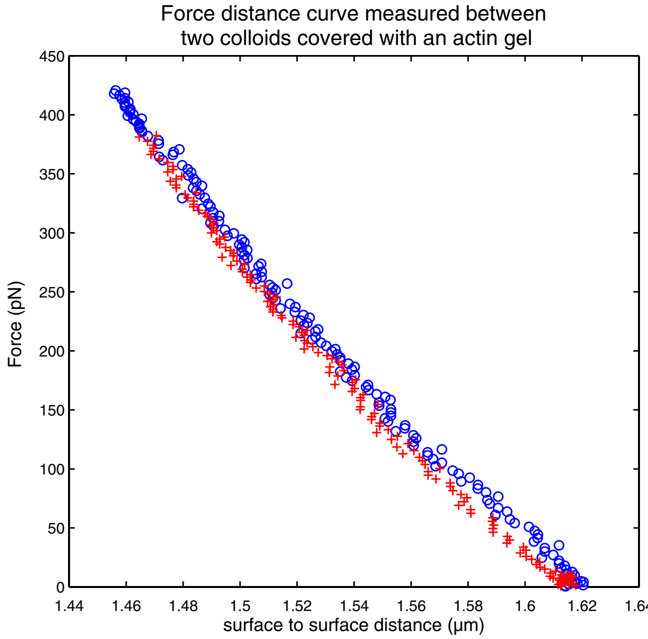

Fig. S1. Typical force-distance curve measured between two magnetic colloids both covered with an actin gel. Blue circle: compression; red crosses: decompression.

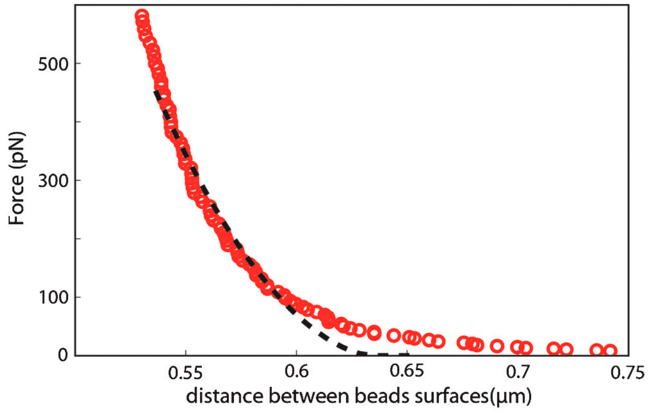

Fig. S2. Typical force-distance curve measured in the absence of phalloidin. Symbol: experimental data; dashed line: fit.

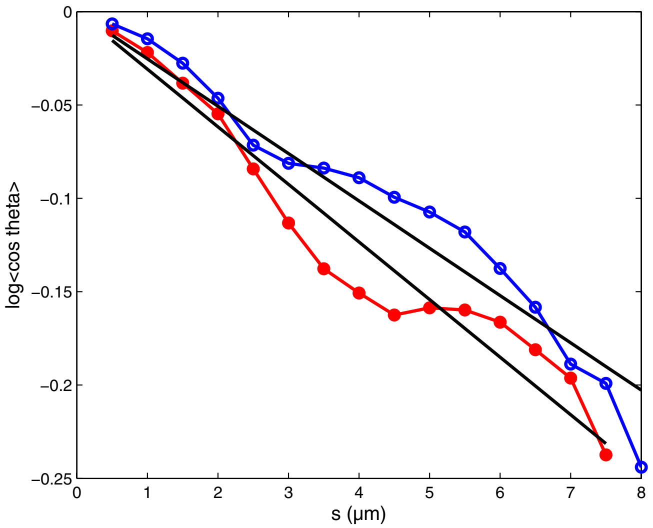

Fig. S3. Determination of the persistence length: Cosine correlation as a function of curvilinear abscissa for phalloidin stabilized actin (blue open circle) and cofilin phalloidin actin (red closed circle). Best fit showing a correlation length of 19.7 and 16.2 μm, respectively. Protocol: F-actin (6.5 μM) is incubated with cofilin (6.5 μM) for 10 min, then diluted 50X in 20 μM rhodamin-phaloidin for 10 min and diluted 6X for observation. Sample preparation, image acquisition, and evaluation of persistence length were made in the same manner as Isambert et al. (1). Measurements of the persistence length of actin stabilized by phalloidin without cofilin were made as a reference. We obtained a persistence length of 19.7 ± 1.5 μm compatible with previous results of 19 ± μm (1). Measurements were made on tens of filaments, and a total of 200 images for each condition have been analyzed.

1 Isambert H, et al. (1995) Flexibility of actin filaments derived from thermal fluctuations. *J Biol Chem* 270:11437–11444.