Supporting Information

Here, we demonstrate the velocity dependence of the motion of a contact line during adhesive contact between two bodies. We opt to use an entirely different geometry (that of Johnson Kendall and Roberts [1-3]) in this demonstration for two reasons: 1) this geometry is well-established and the technique is generally considered the 'gold standard' for measurements of adhesion; 2) by using a vastly different geometry than our actual experiments (i.e. our experiments would be more geometrically similar to a peel test), we can be certain that the measured behavior is due to fundamental processes at the interface and not due to geometry.
Figure S1a. Shows the force versus distance curve recorded as a glass hemisphere (radius 5 mm) is brought into contact with a flat 30:1 PDMS sample (prepared as described in the methods section), and then removed. During this experiment the lens is moved at a constant speed of 0.05 μm/s. It is important to note that the lens speed does not directly compare to the speed of the contact line, which we measure directly through image analysis of the contact patch. The energy release rate (G) can then be calculated for each point along the curve as[3]:

$$G = \frac{\left(4\bar{E}a^3/3R - P\right)^2}{8\pi\bar{E}a^3} \qquad \text{(S1)}$$

where a is the radius of the contact patch, R is the radius of curvature of the sphere, P is the force applied to the hemisphere and $\overline{E} = E/(1-\nu^2)$ the plane-strain modulus with Young's modulus given by E, and Poisson's ratio ν. The result for this experiment can then be combined with measurements at various other lens speeds (Fig. S1b.). The data can then be fit with the empirical equation[3]:

$$G = G_0\left(1 + \left(V/V_*\right)^n\right) \qquad \text{(S2)}$$

where G_0 is a threshold energy, V^* is a crack velocity and n describing the strength of the velocity dependence. In these experiments, we find G_0 =0.15 N/m, V_* = $3.2.10^{-5}$ m/s and n=0.77. While these values are not quantitatively those measured in the main experiment, the interface here is between PDMS and a glass lens and not between PDMS and polystyrene, so is not expected to be quantitatively comparable. The broad features, i.e. the scaling of equation S2, fit the data extremely well in both traditional JKR experiments and our wrinkling experiments.

References

[1] K.L. Johnson, K. Kendall, A.D. Roberts, *Proc. R. Soc. A.*, **1971**, *324*, 301.
[2] D. Maugis, M. Barquins, *J. Phys. D: Appl. Phys.*, **1978**, *11*, 1989.
[3] K.R. Shull, *Mat. Sci. Eng. R*, **2002**, *36*, 1.

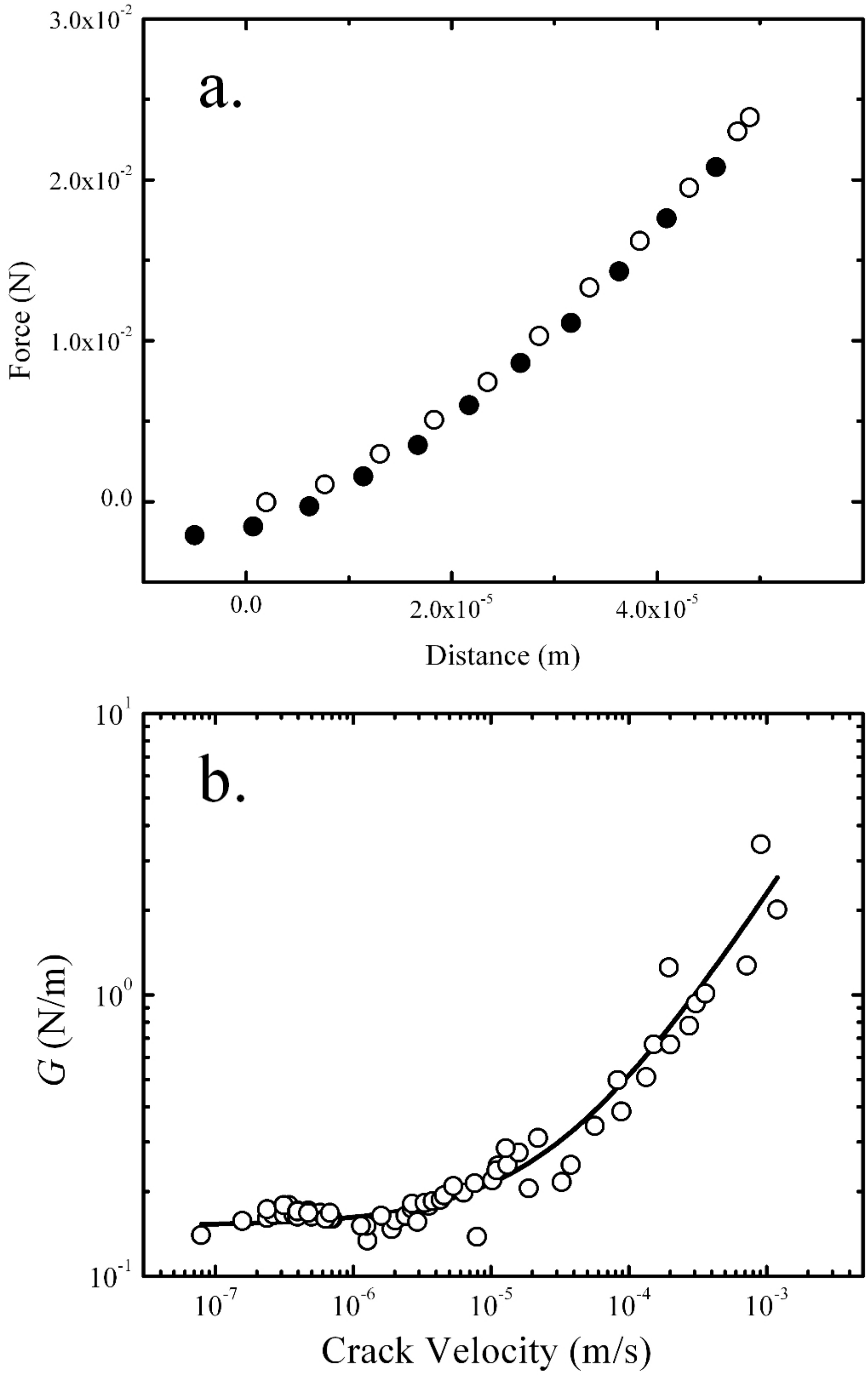

Figure S1. JKR measurements of adhesion between a glass lens and flat elastomer. a. A typical Force vs distance plot showing advancing contact (open symbols) and receeding contact (solid symbols). b. energy release rate as a function of velocity from the data of figure a. and many similar experiments. The solid line is a fit to equation S2 and is described in the text.