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SUPPLEMENTARY INFORMATION

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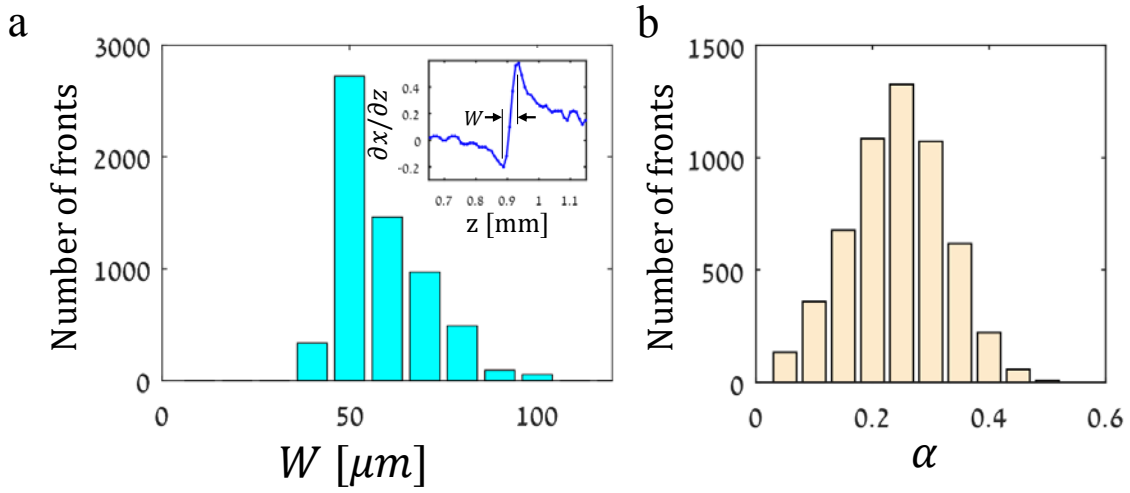
Topological defects govern crack front motion and facet formation on broken surfaces

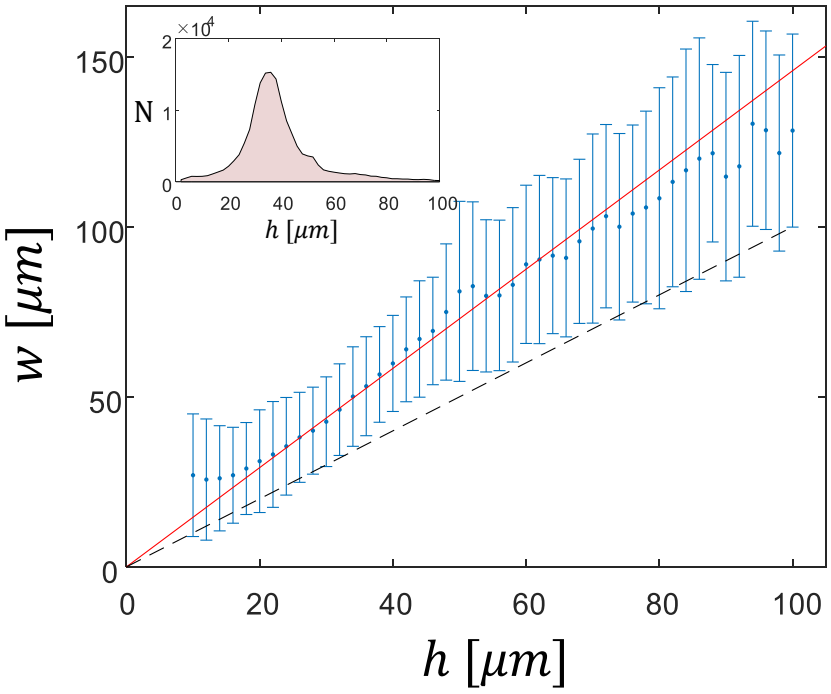
Itamar Kolvin, Gil Cohen and Jay Fineberg

The Racah Institute of Physics, the Hebrew University of Jerusalem, Jerusalem, Israel 9190401

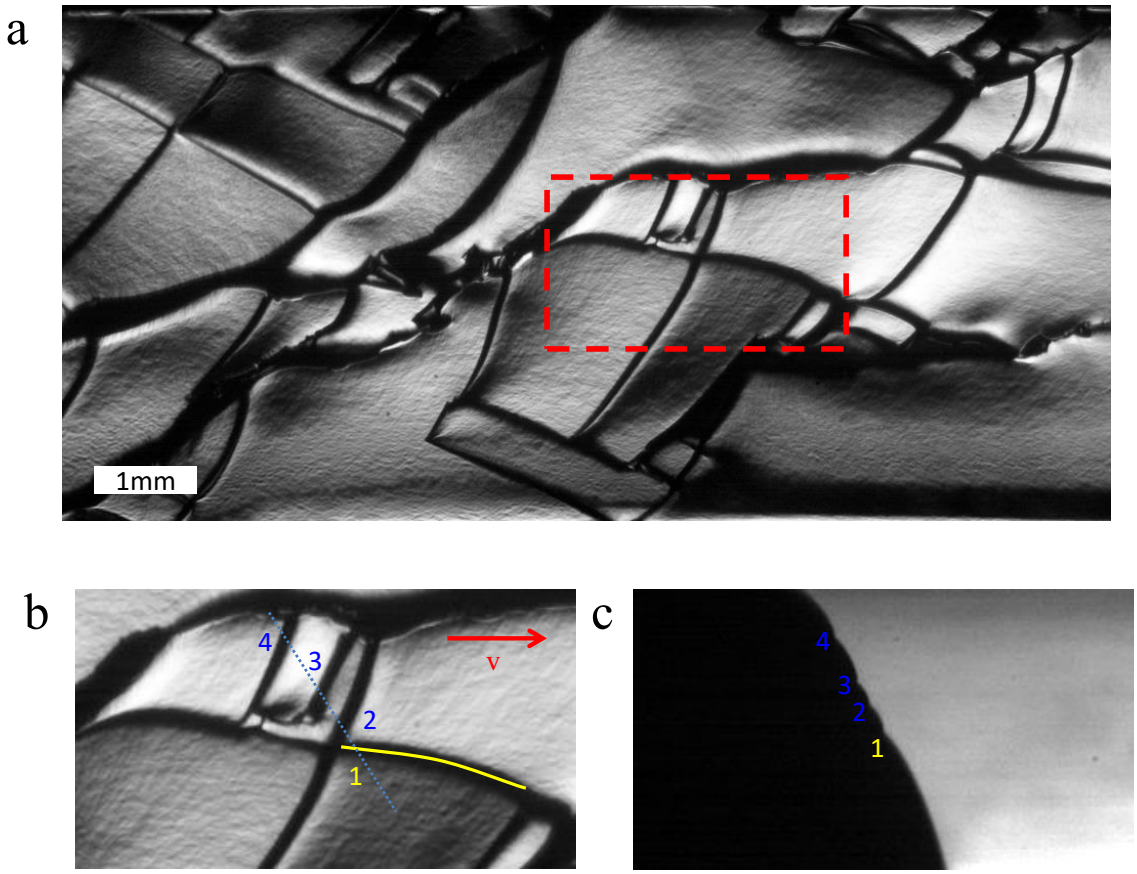
Supplementary figures and movies



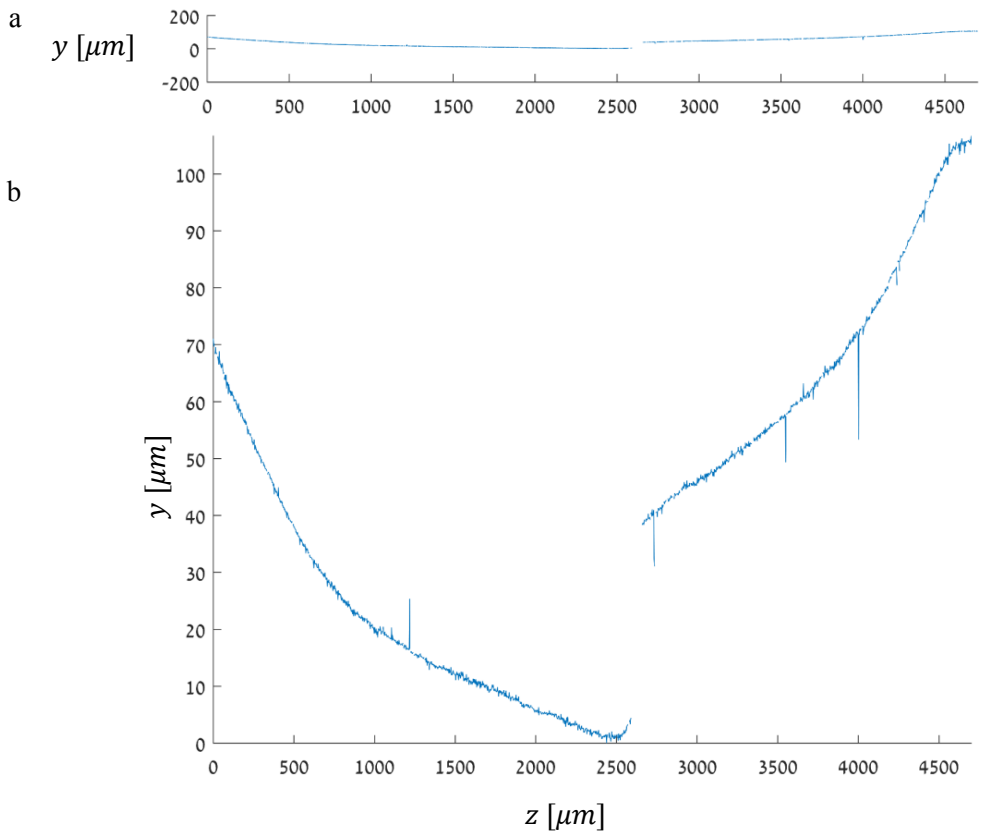
Supplementary Figure 1. **The parameters W and α extracted from isolated step-lines.** (a) Values of W are concentrated around $W = 50^{+10}_{-3}\mu m$. (*inset*) W is determined by measuring the distance between the minimum and the maximum of the front derivative $\partial x/\partial z$. (b) α (asymmetry) values determined from front profiles by fitting to $\delta x(z) = cz + \frac{H}{\pi}\left[\frac{1}{2} log\left(1 + \frac{4z^2}{W^2}\right) \pm \alpha\, arctan\left(\frac{2z}{W}\right)\right]$ assuming a constant $W = 50\mu m$. The distribution yields $\alpha = 0.24 \pm 0.08$



Supplementary Figure 2. **Step width w grows with step height h.** Blue bars show the range of w measured by profilometry when averaged over $2\mu m$ intervals of h. Linear regression (red line) yields a proportionality coefficient of 1.4 ± 0.4. The dashed black line, $w = h$, is one standard deviation below the mean. (*inset*) Number of data points within each $2\mu m$ interval of h. A total of ~155,000 points was considered.



Supplementary Figure 3. **Dependence of step-line direction on the normal to the crack front.** (a) A typical fracture surface in the faceting regime. (b) A section of a fracture surface in (a) with a step-line extending nearly parallel to the X axis highlighted in yellow. Numbers refer to curved points along the front in (c). The dotted light blue line approximates the front tilt in (c). (c) A snapshot of the crack front that created the surface in (b) reveal strong tilting of the front.



Supplementary Figure 4. (a) The height profile along the z axis of a fracture surface containing a single step (at $z \sim 2500\mu m$) taken at a constant x. Except at the step, surface height barely changes, and the wavelength of its variation is of the order of the sample thickness ($\sim$ 4.6 mm). (b) The same height profile with the y axis blown-up by a factor of 45.

Supplementary Movie 1. Propagation of a crack front forming a single step-line at steady state over $50ms$ (interval between frames is $0.5ms$) (see Fig. 2(a,d)).

Supplementary Movie 2. Propagation of a crack front throughout the simultaneous nucleation and growth of two step lines over $30ms$ (interval between frames is $0.3ms$) (see Fig. 2(b,e)).

Supplementary Movie 2. Propagation of a crack front during the merging of two step-lines over $25ms$ (interval between frames is $0.3ms$) (see Fig. 2(c,f)).