

## Re: Why does shattered toughened glass stick together?

**Source:** <http://sci.tech-archive.net/Archive/sci.physics/2004-07/1239.html>

---

**From:** Ian Stirling ([root\\_at\\_mauve.demon.co.uk](mailto:root_at_mauve.demon.co.uk))

**Date:** 07/04/04

Date: Sun, 04 Jul 2004 07:20:52 GMT

Edward Green <[spamspamspam3@netzero.com](mailto:spamspamspam3@netzero.com)> wrote:

> Ian Stirling <[root@mauve.demon.co.uk](mailto:root@mauve.demon.co.uk)> wrote in message  
news:<[gSCFc.2691\\$Fc7.441121@stones.force9.net](mailto:gSCFc.2691$Fc7.441121@stones.force9.net)>...

>> OG <[owen@gwynnefamily.org.uk](mailto:owen@gwynnefamily.org.uk)> wrote:

>>>

>>> "ij Frazir" <[GravityPhysics@webtv.net](mailto:GravityPhysics@webtv.net)> wrote in message

>>> news:<[9650-40E4FA05-23@storefull-3214.bay.webtv.net](mailto:9650-40E4FA05-23@storefull-3214.bay.webtv.net)>...

>>>> I added the vaccume idia too.

>>>> without air between two sheets of glass , one bar is pushing them

>>>> together.

>>>>

>>>>

>>>> Possibly,

>>>> The fact there are internal reflections at the cracks implies that there is

>>>> a pretty large difference of refractive index across them (which means

>>>> either air or vacuum between the fragments of glass).

>>>> The fact that the internal reflections are white (all wavelengths from blue

>>>> to red) tends to suggest that the separation is tending towards several

>>>> huundreds of nanometres.

>

> Mygod, sir, that is a most excellent observation! I thought about

Indeed.

> something like that, and ignored it -- just what does it mean that we

> can see the cracks? OTOH, this does leave open the possibility of

> partial cold-welding, surface adhesion, whatever. That is, say 1% of

> the crack surfaces had essentially rewelded to become contiguous glass

> (low percentage attributable to mechanical mismatch following movement

> of fragments), the rest air or vacuum filled gap, as you say. This

> would account for both the significant yet greatly reduced residual

> strength, and the visibility of the cracks. Failing that we are left

> with the Frazir model: mechanical interlock.

I'm not happy with that model.

Examining the bits, very few of them have shapes that would seem to allow any mechanical adhesion.

sci.physics: Re: Why does shattered toughened glass stick together?

- >
- > *Note to original observer of the Stirling phenomenon: do the sections*
- > *networked with cracks, that you can yet easily pick up as a unit, show*
- > *noticeable flexure when you move them ... like, dare we say, a piece of*
- > *complete jigsaw puzzle?*

No, they are utterly inflexible, feeling just like an unshattered bit, until they fracture (at vastly lower stresses than ordinary of course).

- >
- >> *Hmm.*
- >> *An interesting experiment would probably be to try a similar experiment,*
- >> *but with the pane submerged in water.*
- >
- > *Or oil.*
- >
- > *I have a feeling that the oil would more readily penetrate the cracks.*

Possibl.

- >
- >> *An interesting optical effect might be to put cling-film over one side,*
- >> *to spread coloured epoxy over the other (and the edges), before leaving*
- >> *for a couple of minutes, and wiping off the epoxy, then leaving to set*
- >> *and removing the cling-film.*
- >> *Unfortunately I have no spare toughened glass.*
- >
- > *Just what do you expect to achieve by this treatment?*

Just a fine network of colour in the glass.