

# TECH Notes

## Controlled Defects in Glass

### Assessing Glass Strength Using Controlled Defects

● TN1003 Rev. A0

#### Brittle Fracture is a Statistical Process

Brittle fractures occur by the propagation of a flaw to the point where it exceeds the critical crack length for a particular material. At that point, catastrophic failure occurs nearly instantaneously. Glass that might be used in a touchscreen device or an energy saving exterior glazing is prone to such brittle-fracture behavior. The probability of failure of a piece of glass correlates with the probability of a flaw of critical length existing within the glass, in a zone being stressed. So the probability of failure depends both on the amount of load or stress on the piece of glass, as well as the glass flaw distribution.

#### Improving the Resistance to Glass Failure

To increase the durability of these important applications of glass, there is much interest in research that can:

1. Reduce the sub-critical crack growth rate
2. Increase the critical crack length
3. Arrest the propagation of a crack which otherwise would result in catastrophic failure

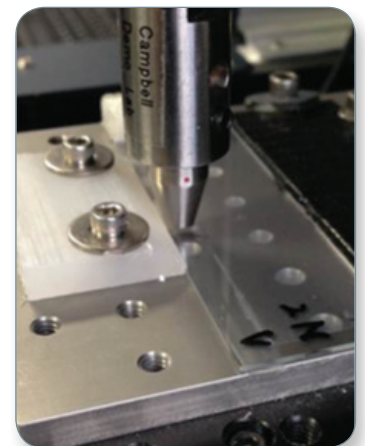
#### A number of approaches are being investigated in this regard, including:

- Coatings
- Compositional modifications
- Microstructural and/or processing changes

#### Research Tools Available

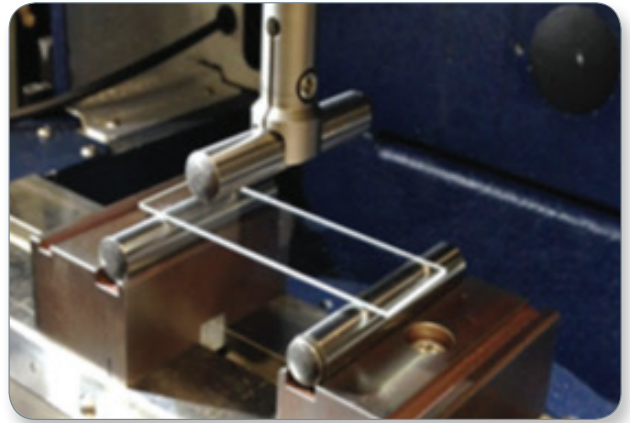
To aid in the research and assessment of methods to improve glass fracture resistance, a means to provide controlled defects in glass can be used. By imparting known defects into a set of glass samples of reasonable statistical size (e.g., 10), and then fracturing these samples under known, controlled conditions, the effect of various treatments can be determined.

A Bruker UMT, equipped with a standard diamond tip, such as a Rockwell indenter, can be used to apply scratches of a



Creating controlled defects in glass.

precise and repeatable length and depth under servo-feedback controlled conditions. Subsequently, a three-point-bend fixture can be installed on the UMT to then fracture the glass under controlled conditions.



3-point-bend fixture for glass testing.

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