

The incidence of the glass composition on the contact damage behavior - A Vickers indentation study

Author: *Tanguy ROUXEL
LARMAUR, EA-410, Bat. 10B, Université de Rennes 1,
Campus de Beaulieu, 35042 Rennes cedex*

Abstract:

The Vickers indentation test allows for a simple comparison of the apparent hardness of glasses and is a good introduction to the more complicated problem of scratching. Nevertheless, although hardness correlates to the resistance of material to permanent deformation, it doesn't bring light on the mechanism of irreversible deformation of glass under sharp contact loading. There are two primary contributions to the permanent deformation process, namely: Volume conservative shear flow and densification. Shear flow is responsible for the residual stresses but densification is not. Therefore, two glasses having the same hardness numbers but for which shear flow and densification contribute to different extents to the indentation deformation may exhibit significantly different overall indentation behaviors regarding indentation-induced cracking, scratchability, damageability, machinability, and so on. Conversely, there are high expectations to improve the hardness or the scratch resistance of glass by playing on the composition to favour one deformation mechanism over the other. When shear flow is favoured, as for metallic glasses, or when densification contributes to a large extent, as for silica-rich glasses, then the glass can accommodate the sharp contact load by relaxing the stresses through the displacement of matter (energy dissipative process). Changes in the deformation mechanism are also observed within a given glass system by substituting one constituent for another. It seems hence that it is possible to tune hardness, damage resistance and possibly fracture toughness by playing on the composition.

Questions to be answered:

1.) What will be a topic stating an exceptional success to be published in a well known high ranking Research Journal in 2025 concerning your presented R&D field of work? Please think in headlines.

2.) Please name up to 10 future key challenges (till 2025) regarding your presented field of expertise and indicate please the specific year when you expect the topic to become a real bottleneck for the future developments.

3.) Concerning the topics, what would be

a) the key breakthrough and when is it likely to occur

b) what must happen concerning the research field if this topic will never be successful
