MICROCOMPRESSION EXPERIMENTS ON GLASSES – STRAIN RATE SENSITIVE CRACKING BEHAVIOUR

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Key Words: microcompression, glass, deformation mechanism, cracking

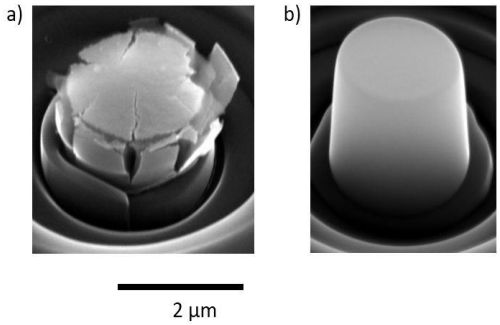

Figure 1 – microcompression experiments on glasses showing stable crack growth (a) and reversible deformation (b)

It is well known that the mechanical properties of glasses are closely related to their atomic structure. The exact structure-property-relationship, however, is only poorly understood even for fundamental mechanisms like shear and densification. Nanomechanical test methods like micropillar compression and nano indentation can help fill this gap. In this study a sodium-boro-silicate glass is quenched from different temperatures to induce changes in the atomic structure. Micropillar compression was used to introduce plastic deformation into these glasses at room temperature under a uniaxial stress state. By changing the strain rate it is shown that deformation shifts from completely reversible deformation, to stable crack growth, and finally brittle failure. It is shown that by changing the glass structure, the strain rates corresponding to these deformation regimes are shifted. Finally, the occurrence of shear and densification is discussed. These findings are analysed against the background of the glass structure.