from σ_f and r or c values obtained on individual specimens indicated it to be a material constant, $\simeq 3.85\,\mathrm{MN\,m^{-3/2}}$, suitable for predicting σ_f or c for water-tested specimens from values obtained in dry N_2 tests. This indicated absence of a dependence of K_{IC} on critical crack depth in the Alsimag 614 suggests that occurrence of the phenomenon in the alumina ceramics is associated with micro-structural other than grain-size effects. Previously, the same effect was noted in pre-notched rock specimens and attributed to a smooth increase in the amount of subsidiary microcracking as the main crack advanced [6].

Acknowledgement

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Crazing under applied compression

Observations of crazing in a glassy polymer in a non-dilational stress field [1, 2] appear to be at variance with stress field criteria for crazing [3, 4] which require a positive value of the first stress invariant I_1. A critical value of the hydrostatic stress component, $\sigma_m = I_1/3$, also satisfies the conditions for the cavitation process [5] which is involved in craze formation. It may be possible to reconcile these observations with theory since crazes initiate from stress-raising flaws and the local stress field may be dilatational even if the applied stress system is not.

In order to examine this possibility, tests have been carried out with a non-dilational applied stress, i.e. uniaxial compression, using a specimen geometry which produces stress reversal at pre-determined positions. Specimens of poly(meth-acrylate) (PMMA) of dimensions 10 mm by 10 mm by 3.2 mm thick with a 2 mm diameter central hole were normalized at $150°\,C$ and tested at $20°\,C$. Tests were carried out at a strain rate of $10^{-2}\,\mathrm{sec^{-1}}$ in a testing machine fitted with a com-pression cage and the specimens were illuminated and were viewed under load with a microscope.

Crazes initiated at a net section stress of $128\,\mathrm{MN\,m^{-2}}$ and it was observed that they formed at the extremities of the vertical diameter as indi-cated by A in Fig. 1. The maximum tensile stress
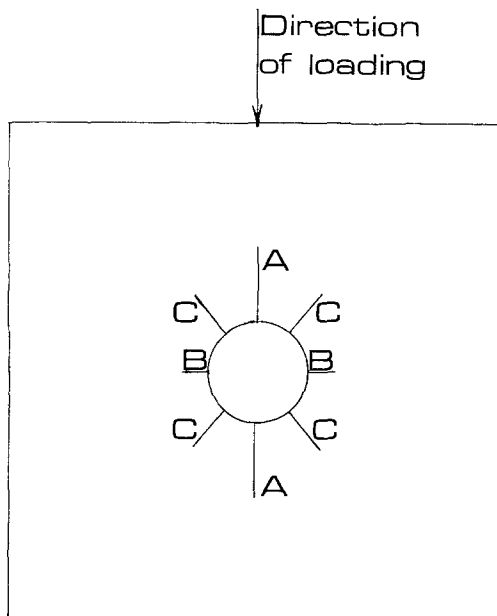

Figure 1 Schematic representation of microdeformation in the relaxed specimen.

in the specimen is normal to the craze direction and the local value of I_1 at initiation is positive. Analysis of the elastic stress field at the craze tip suggests that it is possible for the craze to propa-gate in an entirely compressive stress field. How-ever, this analysis is not complete as it does not take into account the stress field perturbation due to the craze. It is not yet possible to quantify this

effect but it is probable that it will produce a net tensile stress component normal to the craze tip.

An estimate of the craze initiation stress may be made using classical elasticity theory [6] and taking into account the finite width of the specimen. Tensile samples of the same cross-sectional dimensions as the compressive ones were also tested at a strain rate of 10^{-2} sec^{-1} and crazing occurred at a net section stress of $49 \, \text{MN m}^{-2}$. Crazes originated from the ends of the horizontal diameter and the samples fractured due to crack propagation through the crazes. The maximum tensile stress in the sample at craze initiation was approximately the same as that for initiation under applied compression.

When compressive specimens were examined after testing it was observed that in some cases further crazes had formed at the ends of the horizontal diameter as indicated at B in the figure. This crazed region is associated with compressive stresses on loading but further experiments showed that horizontal crazes occurred on unloading. Their growth is therefore attributed to the presence of tensile residual stresses and it is noted that Kramer [7] detected non-Hookean (anelastic and plastic) deformation when he compressed notched samples in his study of shear-banding polystyrene. The maximum residual tensile stress in the present tests is normal to the craze plane at initiation and the local stress field is dilational. This phenomenon does not occur consistently even when the applied stress approaches that at the load maximum. It is associated with cyclic rather than monotonic loading and work is in progress to study the effect of load cycling. Experiments have been carried out in fluctuating compression with a lower limit of zero and various upper limits, in the range $80 \, \text{MN m}^{-2}$ to $110 \, \text{MN m}^{-2}$ net section stress, and horizontal crazes have been produced in all tests.

It was difficult to detect the formation of shear bands but they were observed on crazed specimens as shown by C in the figure. Supplementary experiments were carried out in which samples were loaded to pre-determined levels and were viewed after unloading. When shear bands were obtained they were clearly visible on tilting the specimen slightly from the vertical plane. The net section stress for shear band initiation was found to be $116 \, \text{MN m}^{-2}$.

The present experiments indicate that the hypothesis that the local stress field is dilational at craze initiation is plausible and they demonstrate the desirability of taking local stresses into account wherever possible. The work is being extended to investigate environmental effects.

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Direct observation of the polytype periodicities in the Be–Si–O–N system

A new class of polytypism, in which the unit cell is determined by the composition rather than by a periodicity of displacement faulting, has been reported to occur in the so-called "Sialon" ceramics [1]. The purpose of this note is to present direct lattice fringe observations of polytypism in one such ceramic, the Be–Si–O–N system.

The polytypes were first reported to occur near the AlN corner of the Si–Al–O–N system [2], but structurally similar ones have since been found in the Be–Si–O–N, Mg–Si–Al–O–N, and Li–Si–Al–O–N systems [3]. In all these alloy systems