susceptible to oxidation and yellowing. XP-5272 was of most interest in combination with low temperature curing polyesters and polyurethane potting resins.

Tenite PTMT-650 (polytetramethylene terephthalate) is medium in cost and has exceptional heat resistance. It processes well and has good flexural properties and good solvent resistance.

The cap materials were encapsulated by the following potting resins: anhydride-cured cycloaliphatic epoxy; anhydride-cured aromatic epoxy; styrenated polyester; polymeg-based polyurethane; diallyl phthalate (DAP)/lauryl methacrylate (LMA), 80/20; and DAP/epoxy interpenetrating polymer networks (IPN).

Injection-moulded cups (5 cm^3) of various cap materials were potted with anhydride-cured cycloaliphatic epoxy and cured at 125° C for 12 h. Adhesion was then determined by a method described in previous paper [1] (see Table III).

Cycloaliphatic epoxy did not adhere well to Polypropylene 6523 but showed excellent adhesion to Nylon 612, Arylon T and PTMT. It also showed good adhesion to polycarbonate.

The adhesion of epoxy and DAP potting resins to modified nylons are shown in Table IV. Rubber modified nylon gave superior results with the DAP potting resin. Acrylic modification did not improve the adhesion.

The results of adhesion tests on potted cycloaliphatic epoxy, after 1 000 h in an 85° C/85% r.h. environment are shown in Table V.

To be useful, the cap material and the potting resin must be combined to make a functional assembly. Factors such as compatability of cap material with potting resin and freedom from cracks and separation between cap structure and the potting resin must be considered. The reactions of potting resins with various cap materials are summarized in Table VI.

Compatible systems are those in which there is little or only slight attack of the potting resin on the cap during curing. This promotes adhesion of the potting resin to the cap. If the solvent attack is too great it will cause deformation of the cap.

For cycloaliphatic and aromatic epoxy potting resins, Nylon 612 and Arylon T are better cap materials than polycarbonate. Their superiority stems from their good adhesion to epoxy potting resins and their ability to retain adhesion after 1 000 h in an 85° C/85% r.h. environment.

The adhesion of the DAP/LMA resin to Nylon 612 and modified Nylon ST-801 is good. DAP/aromatic epoxy IPN also has good adhesion to Nylon 612 and produced promising encapsulated parts. The IPN described, in combination with a Nylon 612 cap, represents a potentially superior and advanced system compared with the polycarbonate—cycloaliphatic epoxy system.

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Dielectric properties of some oxynitride glasses

Currently there is considerable interest in the preparation and properties of oxynitride glasses [1] in which, because some of the oxygen has been replaced by nitrogen, new families of glass systems may be envisaged which may have advantageous physical properties. Initial measurement of the dielectric properties of some calcium—aluminium—silicon and magnesium—aluminium—silicon glasses recently prepared by Jack *et al.* [2] at the Uni-

TABLE I Compositions of the glasses investigated and their dielectric constants

Sample	Composition in atomic per cent						ϵ' (1600 Hz)	ϵ_∞
	Mg	Ca	Si	Al	O	N		
(1)	17	—	17	6	60	—	6.8	2.46
(2)	17.4	—	17.4	6.6	51	7.6	8.3	2.71
(3)	—	17	17	6	60	—	8.8	2.59
(4)	—	17.2	17.2	6.5	54.2	4.9	9.7	2.77
(5)	—	17.3	17.3	6.5	53.1	5.8	10.1	2.80

versity of Newcastle-upon-Tyne are reported here. The compositions of the glasses examined are given in Table I.

Room temperature measurements of the real (ϵ') and imaginary (ϵ'') parts of the dielectric constant and the a.c. conductivity (σ_{ac}) were obtained over a frequency range from 10^3 to 10^4 Hz using bridge techniques. These have been described in detail by Thorp and Rad [3] and Rad [4]. It was necessary to make careful estimations of the edge effect corrections and an overall accuracy of ± 6% was obtained. Specimens of diameter 1 cm and thickness 0.05 cm were used, having been prepared from bulk glass samples by conventional diamond wheel cutting techniques followed by diamond paste polishing to a 0.25 micron finish. Circular gold electrodes were evaporated on to the large specimen faces to ensure

good electrical contact to the electrodes of the measuring jig.

The values of ϵ' for the various compositions are also given in Table I and the variations of $\log(\epsilon' - \epsilon_\infty)$ with $\log \omega$ are shown in Fig. 1. In deriving this figure the value of ϵ_∞ has been estimated from optical refractive index data supplied by Drew [2]. The data for each particular composition fits well with the Universal dielectric response law

$$(\epsilon' - \epsilon_\infty) = \omega^{(n-1)}$$

and from the slopes of the individual plots it was found that, for all compositions, $n = 0.99 \pm 0.02$. Two additional points are evident. Firstly, the addition of nitrogen increases ϵ' for both the magnesium and calcium glasses at any frequency in the range examined; secondly, changing from
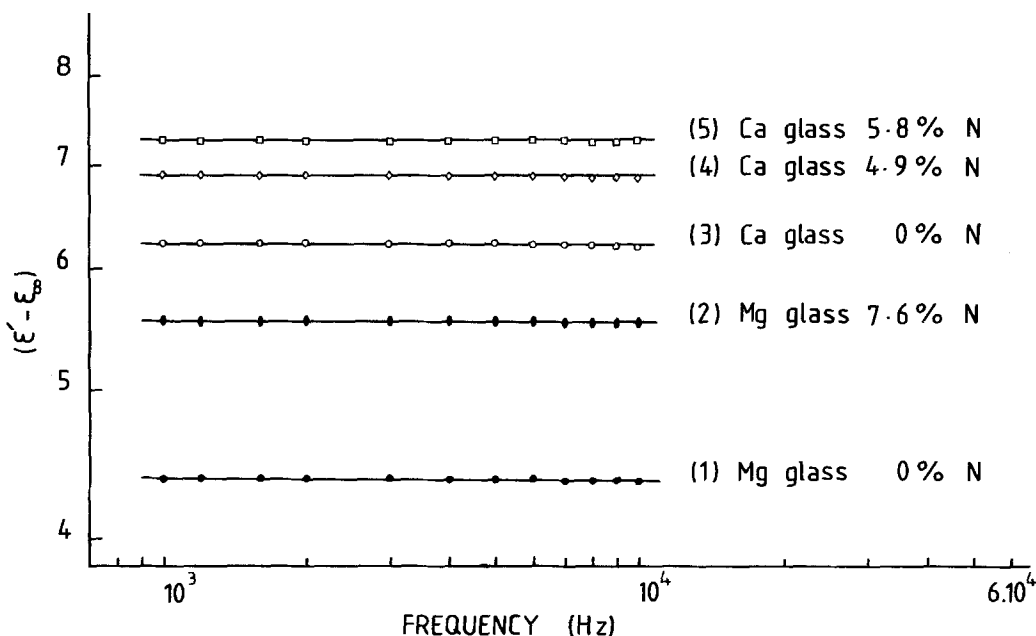

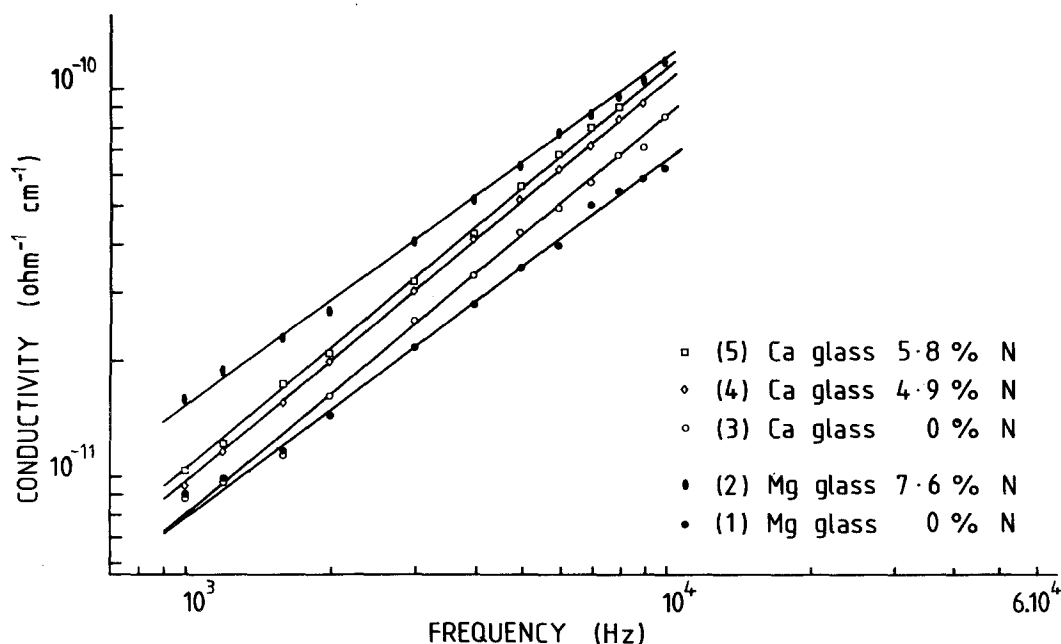Figure 1 The dependence of $(\epsilon' - \epsilon_\infty)$ on frequency and composition.

Figure 2 The dependence of conductivity (σ_{ac}) on frequency and composition.

magnesium to calcium also increases ϵ' in either the pure oxide or oxynitride systems.

The corresponding conductivity data is given in Fig. 2. Again the plot for each separate composition fits well with the variation expected for a hopping conductivity mechanism in that $\sigma_{ac} \propto \omega^n$. In the calcium glass the n value derived from the conductivity data (i.e. $n = 1.0 \pm 0.1$) agrees well with that found from the $(\epsilon' - \epsilon_\infty)$ plot. However, in the magnesium glass the n value derived from the conductivity variation (i.e. $n = 0.90 \pm 0.1$) seems rather less than the value obtained from Fig. 1, though it should be borne in mind that it is more difficult experimentally to make precision measurements of σ_{ac} than of ϵ'. It is interesting to note that the conductivities found here at room temperature in the kHz range are broadly similar to those reported by Leedecke and Loehman [5] in the yttrium–aluminium–silicon oxynitride glass system at 100 kHz and rather higher temperatures; an increase in ϵ' due to nitrogen addition was also reported in an yttrium–aluminium–silicon glass at room temperature.

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