Introduction

While considerable experimental work has been done recently on the state of absorbed films by means of dielectric measurements, there has been very little agreement on the mechanisms involved in the observed dielectric relaxation processes and much confusion exists today. A large amount of the published work is on the silica gel: water system, at least two electrical dispersions have been observed (1-4) and opinion is divided between a Maxwell-Wagner type and a Debye type for the low frequency absorption band. The balance of evidence seems to favour the former mechanism. The absorption of water on certain clay mineral-water systems has also been studied (5, 6) and it has been shown that as the thickness of the film of water molecules increases the state of the water molecules approaches that of the state of the molecules in liquid water. Nelson et al. (7) have also assumed a Maxwell-Wagner-type mechanism in the interpretation of data on the absorption of water on magnesium hydroxide. They also obtained a second absorption band and have argued that this band is due to dipole orientation. The positions of the loss maxima ($10^2$ to $10^7$ cycles per second) may indicate that the absorbed water exists in a far more highly ordered state than in liquid water, and this has been suggested by a number of authors (7, 5). The balance of evidence seems therefore to favour a Maxwell-Wagner mechanism for the first absorption band and a Debye, dipolar mechanism, for the second.

This work is concerned with measurements on two phase dispersed systems where the continuous phase, in most cases, is a dilute aqueous electrolyte solution. This system, which is more clearly defined in the Experimental section, consisted of a packed bed of either finely graded sintered alumina or carborundum, of known particle size, or a packed bed of fibres. Conductivity measurements over a wide frequency range were used to calculate an arbitrary function "the frequency dependent increment of loss factor" which is related to the loss factor as normally defined by a constant. Unfortunately this could not be obtained and hence an arbitrary function has to be used.
Experimental

The measurement system used in this work was of the parallel plate type and the solids were placed in the cell by sedimentation. Measurement of the resistance of the system was made with a Wayne-Kerr B 601 Radio Frequency Bridge. The source was a Wayne Kerr type 701 Signal Generator and the detector a communications receiver. The bridge was calibrated by measuring the resistance of standard potassium chloride solutions. The bridge was calibrated by measuring the cell by sedimentation. Measurement of the resistance at 1500 cycles per second for all frequencies from the potassium chloride measurements against the ionic loss at least up to 30 megacycles per second. The continuous medium was usually water, but runs were also made with glycerol-water mixtures of different viscosities, aqueous acetone, ethylene glycol and nitrobenzene. With the fibre-water systems the viscosity was determined with an Ostwald viscometer and, for simplicity, is recorded as time of flow, in seconds. It appears that the specific conductivity is of more importance than the viscosity as for pure water passed through the same plug the ratio of conductivities at 5 megacycles per second is 5. The specific conductivity of this water was $0.93 \times 10^{-6}$ ohm$^{-1}$ cm$^{-1}$. The glycerol-water-carborundum system giving a similar result i.e. ratio of conductivities 4.9 at 5 megacycles per second has a specific conductivity of $0.86 \times 10^{-6}$ ohm$^{-1}$ cm$^{-1}$ and a ratio of viscosities, viscosity of solution to viscosity of water, of 18.7. The curves have the same shape and in fact are identical allowing for experimental error. It seems therefore that viscosities are not as important as the specific conductivity of the continuous phase.

Results

With the carborundum and alumina systems measurements were made on different grades of different particle size. The commercial grades and their diameter in microns is shown in table 1. The packing fractions in the wet plugs (10) were in the range 0.5-0.6.