CHEMISTRY LETTERS, pp.579-580, 1974. Published by the Chemical Society of Japan

DIELECTRIC BEHAVIOR OF 2-METHYL-2-PROPANOL IN BENZENE AND PYRIDINE SOLUTIONS

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The principal relaxation time of 2-methyl-2-propanol decreases with an addition of solvent (benzene and pyridine). The difference in the hydrogen-bonding capacity of the solvent is not so important in this alcohol as 1-butanol and other isomeric butanols.

Dielectric constants ε' and losses ε'' of mixtures of 2-methyl-2-propanol with benzene and pyridine were measured at 25°C at the frequencies, 350 - 2100 MHz.[1),2)] Fig.1 shows representative Cole-Cole diagrams from the measured values and arrows in the figure indicate the points obtained at 1000 MHz. The principal relaxation time τ of the alcohol was calculated using values obtained at the frequencies lower than 1000 MHz by the method previously described.[2)]

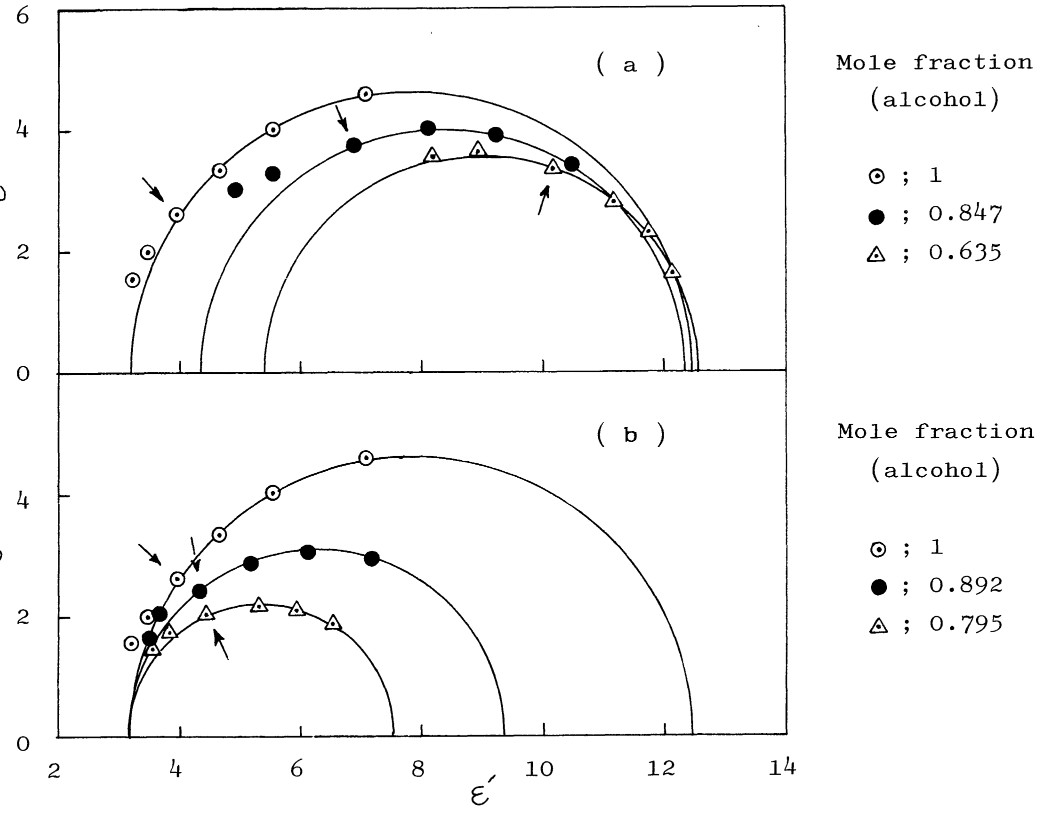

Fig.1 Cole-Cole diagrams for 2-methyl-2-propanol mixtures with (a) pyridine and (b) benzene at 25°C.

Fig.2 (d) shows that the principal relaxation times τ of 2-methyl-2-propanol decrease with an addition of solvents; and (a), (b), and (c) in Fig.2 are results for the other butanols from the previous measurements.2),3) At a glance it will be seen that the curves B for benzene solutions approach to the curves A for pyridine solutions in order of (a), (b), (c), and (d). Further, we find considerable changes in the shape of the curves B from (a) to (d); a moderately inclined and slightly convex curve in (a) becomes a strongly inclined and concave curve in (d).

The principal relaxation time is not associated with a single alcohol molecule but rather with molecules in hydrogen-bonded clusters. And the structure of these clusters seems to be deformed or destroyed with an increasing amount of benzene most easily in the case of 2-methyl-2-propanol for which the steric hindrance about the OH group in the alcohol is expected to be considerable.

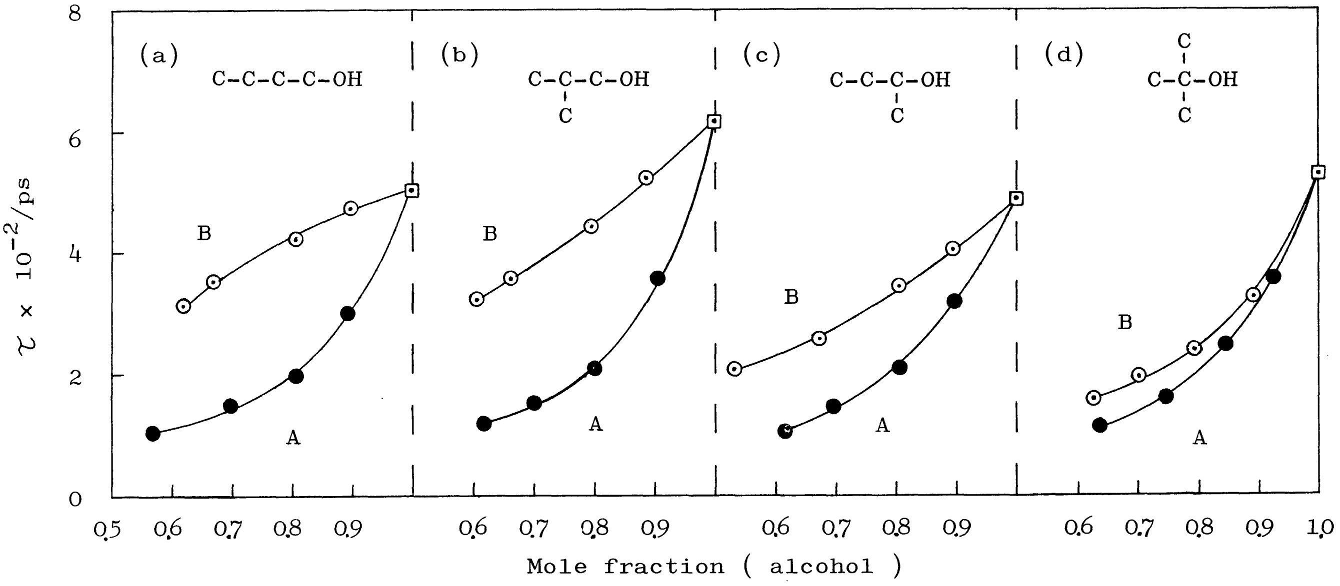

Fig.2 Variations of principal relaxation times τ with mole fractions at 25°C ; isomeric butanols mixed with (A) pyridine and (B) benzene.
(a) 1-Butanol, (b) 2-methylpropanol, (c) 2-butanol, and (d) 2-methyl-2-propanol.
Solvent : ⊙ ; benzene, ● ; pyridine, ⊡ ; pure alcohol

References

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(Received April 24, 1974)