Frequency Dependence of Conductivity and Delectric Properties of the Polytetrafluorethylene – Silver Iodide System.

N. F. Uvarov[1], E.F.Hairetdinov[1], V.M.Buznik[2], A.K.Tsvetnikov[3]

[1]Institute of Solid State Chemistry and Mechanochemistry, Siberian Branch of Russian Academy of Sciences
Novosibirsk-128, 630128, Russia

[3]Habarovsk Department of the Russian Academy of Science, Habarovsk, Russia

[2]Institute of Chemistry
Far East Branch of Russian Academy of Sciences, Vladivostok, Russia

Composites of the "ionic salt-polymer" type may be used in many electrochemical devices. The composites polytetrafluorethylene (PTFE) – AgI may be regarded as a suitable model system for such studies. In this work conductivity, dielectric permittivity and dielectric loss of PTFE – AgI composites have been studied as a function of purity of AgI, type and concentration of PTFE. have been varied. Dielectric properties of the composites have been investigated with a HP-4284A Precision LCR Meter in a frequency range 20-10^6 Hz, dc conductivity was measured using a B7-30 Electrometer at temperatures 20-200^{o}C.

In general, dc-conductivity of the composites prepared from very pure silver iodide obeys the percolation models with percolation threshold of about 40 vol%. Analysis of experimental frequency dependencies of conductivity, $\sigma(\omega)$, dielectric permittivity, $\varepsilon(\omega)$ and tangent of dielectric loss, $tg\delta(\omega)$, shows that they may be described in terms of mixing equations proposed earlier [1,2]. All the frequency dependences are of non-Debye-type. In the vicinity of the percolation threshold p_c there is a maximum of the dielectric constant (See Fig.). At $x>p_c$ a maximum on $tg\delta(\omega)$ dependences is observed typical of the Maxwell-Wagner relaxation in dielectrics containing conducting inclusions.

Surprisingly, at low concentration of AgI (less than 10 vol%) conductivity of the composites increases. This increase is the most pronounced if silver iodide is not pure and contains impurities of metallic Ag. This effect may be explained by strong adhesion of small particles of metallic silver to PTFE. As a result, the process of the annealing the extended defects in AgI strongly slows down.

References

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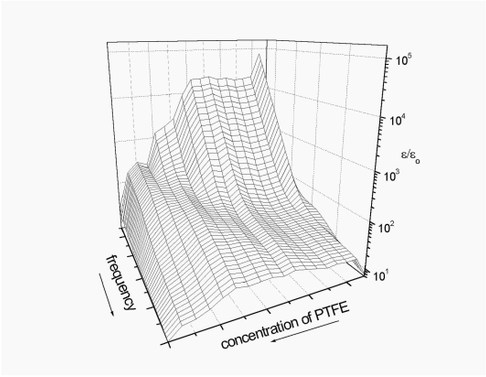

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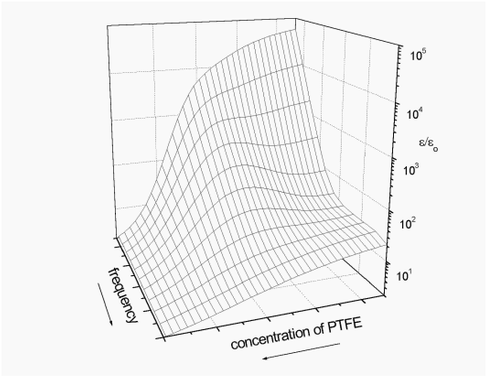

Fig.1. Experimental (a) and theoretical (b) dependencies of dielectric constant on frequency and concentration for AgI-PTFE composites

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