Capability of spin probe technique in determining of molecular organization of graphite oxide materials

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Graphite oxide (GO) is a layered material formed by graphene planes decorated with oxygen-containing groups. GO swells easily in polar liquids with intercalation of the liquids into the inter-plane space. It is known that intercalated substances do not demonstrate “liquid – solid” phase transition which is characteristic for bulk liquids. Membranes formed by GO were found to possess highly selective permeability for liquids and hydrated ions; the reasons of this phenomenon are not clear.

Up to now, detailed study of molecular organization of GO materials was hindered by lack of suitable experimental methods. In the report it will be shown that X-EPR spectroscopy of spin probes is a promising method for such investigations. The report will demonstrate the capability of spin probe technique for study of the phase state of polar substances intercalated between the graphene planes, and for quantitative characterization of orientational alignment of GO membranes. As an illustration, Figure 1 shows EPR spectrum of spin probe TEMPO in the system “GO – acetonitrile”. The spectrum is superposition of three signals, namely, the native signal of GO and two signals of TEMPO characterized by fast and slow rotational mobility. Fast rotation is typical for the radicals dissolved in liquid media; hence, there is liquid-like acetonitrile in between the graphene planes. However, the shape of the spectrum indicates the lower mobility of intercalated acetonitrile in comparison with the bulk one.

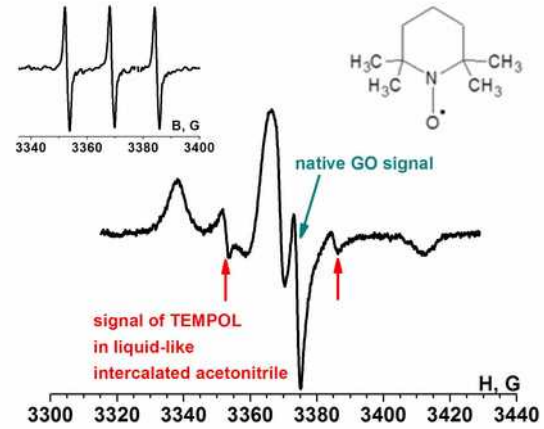

Figure 1. EPR spectrum of spin probe TEMPO in the system “GO – acetonitrile”; insert is EPR spectrum of TEMPO in bulk acetonitrile.