Polymer-Magnet Nanosystems

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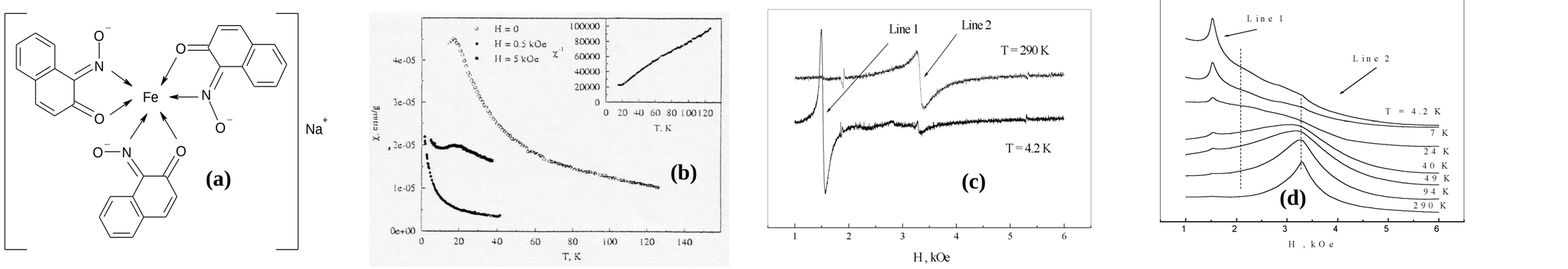
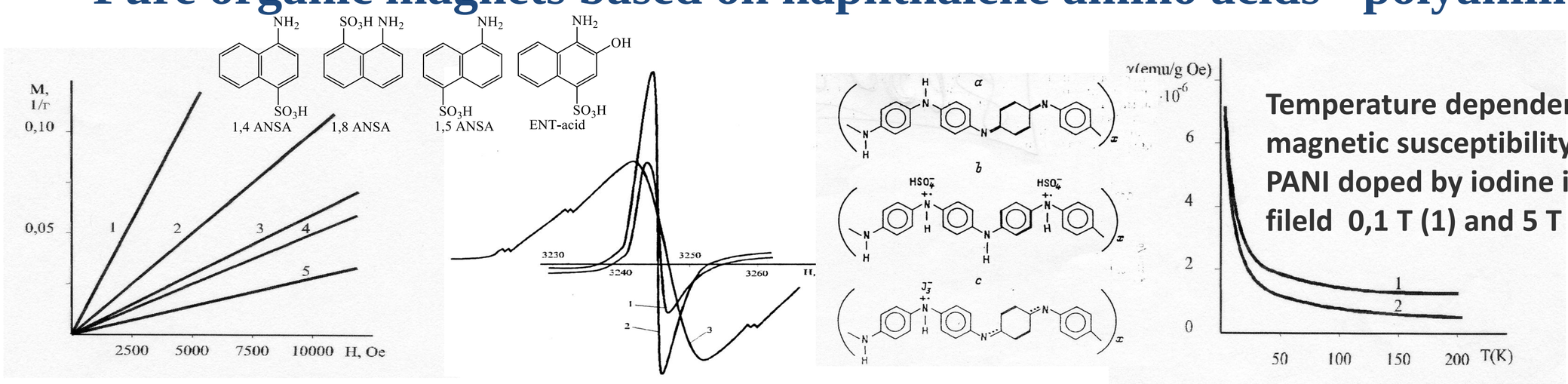
The need to create an organic magnet is due to a number of expected advantages, such as lightness, transparency, flexibility, ability to switch under the influence of light (magneto-optics), sensitivity to external influences (sensors), creation of modern toners for digital printing, adsorbers of radiation, etc.[1]. In this report, we are considering the methods of synthesis, structure, magnetic and other properties of the new organic molecular magnetics based on organometallic complexes [2], pure organic magnets and conducting polymers doped with magnetic probes [3], and the polymers filled with transition metal oxides nanoclusters [4].

Organometallic complexes



(a) Molecular structure of the complex $Na[Fe(C_{10}H_6NO_2)_3]$; (b) Temperature dependence of magnetic susceptibility at different magnetic field strengths: H = 0; 0.5 and 5 kOe. Box: Temperature dependence of the inverse magnetic susceptibility of $Na[Fe(C_{10}H_6NO_2)_3]$; (c) - EPR spectrum of Fe^{3+} ion in $Na[Fe(C_{10}H_6(NO_2)_3$; (d) The shape of the absorption line of the EPR spectrum of $Na[Fe(C_{10}H_6(NO_2)_3]$ for temperatures *T* = 4.2, 7, 24, 40, 49, 94 and 290 K.

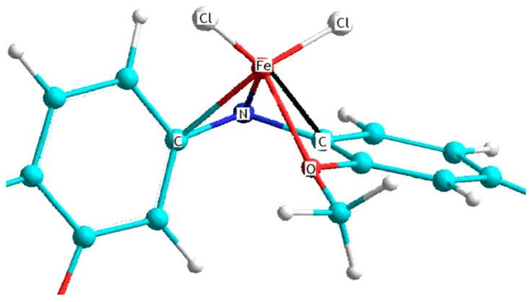
Pure organic magnets based on naphthalene amino acids - polyaniline



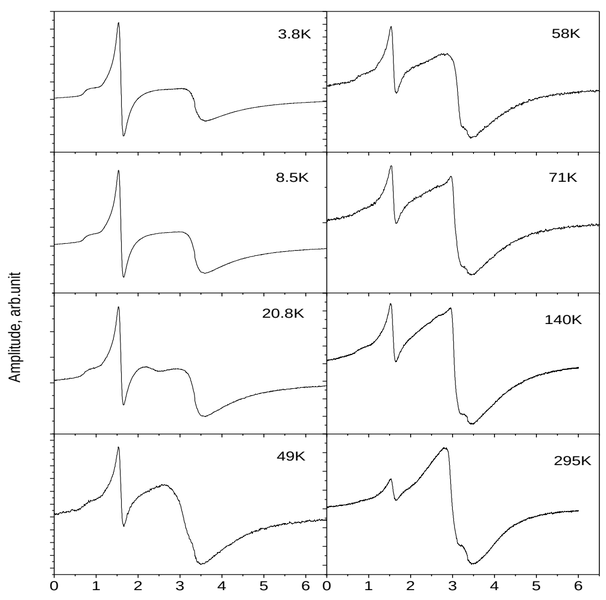
Temperature dependence of magnetic susceptibility of PANI doped by iodine in the fileld 0,1 T (1) and 5 T (2)

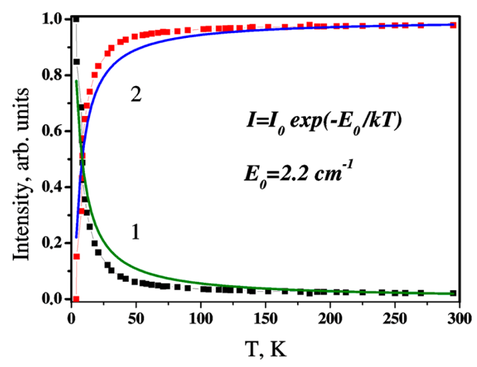
(a) Field dependence of magnetization at T = 4.2 K : 1– poly(1,8-ANSA+An), 2 – poly(1,5-ANSA+An); 3- poly(ENT+An); 4 – poly(1,4-ANSA+An), 5 – PANI doped H_2SO_4; (b) EPR spectra at T = 298 K of poly(1,8-ANSA+An) (1, 3), poly(1,4-ANSA+An) (2) copolymers, a molar ratio is 1:3 (1) and 1:1 (2, 3)

Organic magnets based on conducting polymers doped with magnetic ions



Molecular structure of a poly-ortho-anisidine chain fragment and EPR spectra at different temperature





The temperature dependence of the intensity of the lines 1 and 2 of the EPR spectrum of the ferromagnetic ions in the poly-orthoanizidine for the temperature interval T = 4.2-295 K

Conclusion

The polymer-magnet nanosystems were fabricated on the base of conducting polymers doped with magnetic ions and rpure organic magnets whthout metal dopant. A new temperature effect was found in the behavior of magnetic probes. This phenomenon can be used in biology and medicine to monitor and predict the behavior of nervous cells.

References

1. Miller J.S. Organic- and molecule-based magnets // Mater. Today.-2014.-**17**.-P. 225-235.
2. Dyakonov V.P., Zubov E., Aksimentyeva E., et al. Low-temperature magnetic behavior of the organic-based magnet $Na[FeO_6(C_{10}H_6N)_3]$ // Low Temp. Phys.-2014.-**40.**-P. 835-841
3. Shapovalov, V., Dmitruk A., Aksimentyeva E., et al. Dynamic Characteristic of Molecular Structure of Poly-Ortho-Methoxyaniline With Magnetic Probes"// The Journal of Phys. Chem.C. 2013, 117, 7830−7834
4. Aksimentyeva O. I., Savchyn V.P., Horbenko Yu. Yu. et al. Modification of polymer-magnetic nanoparticles by luminescent and conducting substances // Mol. Cryst. Liq. Cryst. – 2014. – Vol. 590. – P. 35–42.