PHYSICO-CHEMICAL PROPERTIES OF HELIX AK-1 IN STABLE PARAMAGNETIC STATE

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The Helix AK-l compounds have been synthesized. The samples obtained under laser radiation are shown to be stable paramagnetic compounds. The EPR spectra indicating a considerable contribution of spin-orbital interaction have been investigated. Electrical and dielectrical properties of samples have been studied in the temperature range of (290-340) K. The luminescent and transmission spectra of the samples at 0.3-0.6 μm have been investigated.

1. INTRODUCTION

Recently, the works on technology of obtaining the paramagnetic organic substances and the investigations of their physical properties have been carried out rather intensively. The interest in materials of such a type is firstly due to perspective of their application in medicine,

As it is known, the drugs are more effective in a stable paramagnetic state due to their active interaction with a biological medium in this case. Great amount of synthetic compounds in a paramagnetic state has been synthesized by physico-chemical methods. However, the obtained substances reveal the paramagnetic properties, in a short time, mainly, that decreases the effectiveness of their application [1]. Therefore, the technological works on the stable paramagnetic compound synthesis are great importance.

The development of the method of obtaining the stable paramagnetic substances (European Patent, 1990 [3]) has been reported by E. Büyükkoca [2]. The stable substances have been synthesized in reactor under radiation of ruby or sulphire lasers at which the stable paramagnetic complexes have been formed. Different compounds of Helix AK-1 type, ($C_{18}H_{18}O_{10}KCl$), transformed under appropriate laser radiation into the stable paramagnetic state have been obtained by technology described in [2].

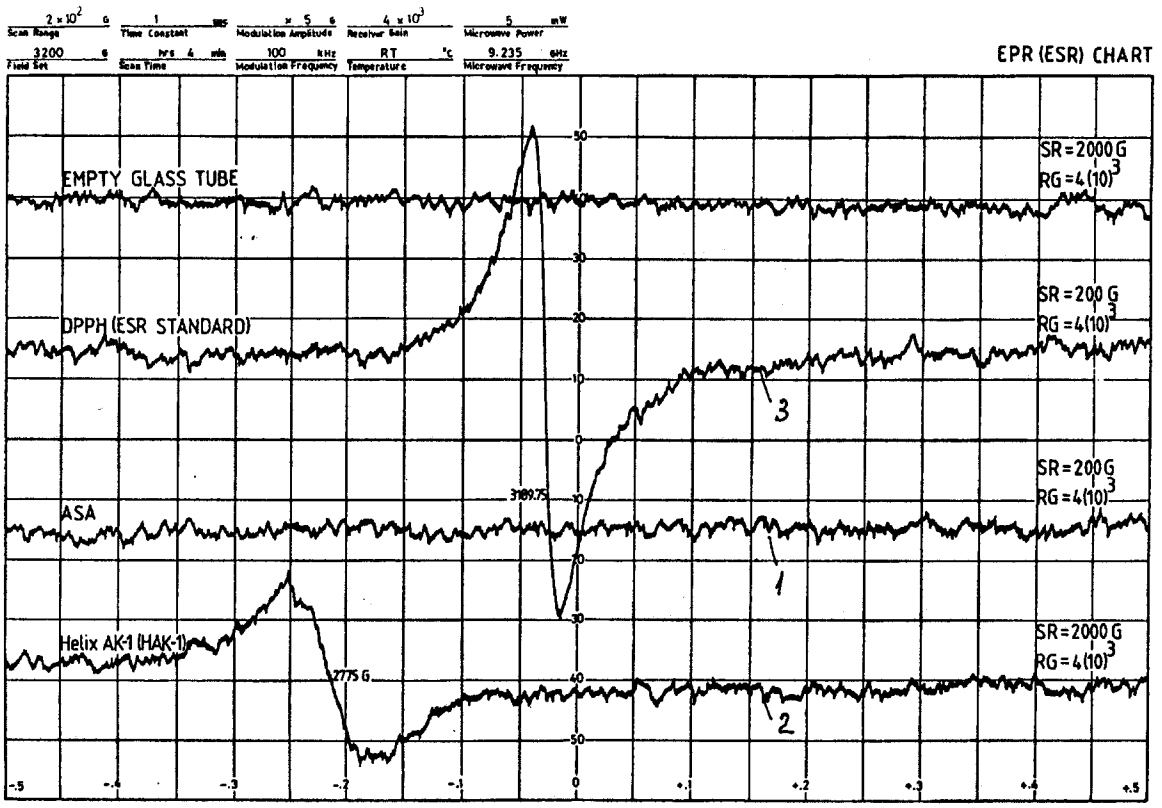

Fig.1. Electron-paramagnetic spectra of Helix AK-1 substance obtained by usual technology (curve 1) and. under laser radiation effect (curve 2). The curve 3 denotes the EPR standard spectra.

2. RESULTS AND DISCUSSION

The present paper deals with the investigation of certain physico-chemical properties of Helix AK-l compound. All the measurements have been carried out in vacuum of $1.5 \cdot 10^{-3}$ Torr. The tablets of ~ 1.5 mm in thickness and ~ 8 mm in diameter, pressed from the powder of the given compound at temperature of ~ 300 K have been used as the samples. To study the current voltage ($I-U$) characteristics, the dielectric constant (ε) and the dielectric loss tangent ($tg\ \delta$), the silver contacts have been deposited on the pressed tablets. The sample resistivity was ρ ~10^9 Ohm·m. The dielectric constant, ε, and the dielectric loss tangent, $tg\ \delta$, were measured at frequency of 1 kHz in the temperature range of 293-333 K. A slight change of ε, 10.7-9, in the given temperature region is probably due to decrease of dielectric constant of polymer molecules. The dielectric loss of structures at room temperature is $tg\delta \sim 0.015$. A narrow temperature range has been chosen due to the change of a chemical composition in such structures at higher temperatures.

The obtained samples have also been investigated by electron paramagnetic resonance (EPR). Figure 1 shows the EPR and the spectra of samples obtained by usual technology (curve 1) and laser radiation interaction (curve 2). As it is seen in Fig. 1, unlike the samples obtained by usual technology, the EPR signals occur in samples obtained under laser radiation. It should be noted that the paramagnetic state is stable for samples studied and the measurements performed in 90 days have shown that no considerable changes take place in the EPR spectra. In the EPR spectra of samples synthesized under the laser radiation, unlike those obtained by usual technology, one can observe the single lines with the superfine structure indications, the g-factor of which shifts toward the lower fields as compared to that of free electron that points to the contribution of spin-orbital interaction. In this case, the g -factor of the observed line ~ 2.30.

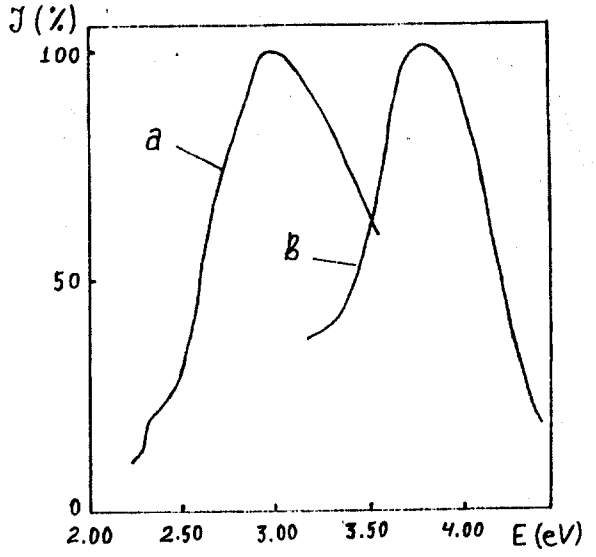

Fig.2. The photoluminescent spectra of Helix AK-1 samples.
a) the radiation spectra of the samples,
b) the excitation spectra of the samples.

The studies of the luminescence spectra of the samples (Fig.2) have not revealed a considerable difference for samples obtained both by traditional methods and laser radiation. The above spectra have the maximum at λ_{max}=426 nm and a line half-width of E~1 eV (curve 1). The excitation spectrum maximum is λ_{ext}^{max} = 326 nm (E=3.8 eV) and a line half-width is E ~0.73 eV.

The investigations of the transmission spectra of samples at λ ~0,3-0.6 μm have also not revealed a significant difference for samples obtained by usual technology and laser radiation (Fig.3, curves 1 and 2, respectively).

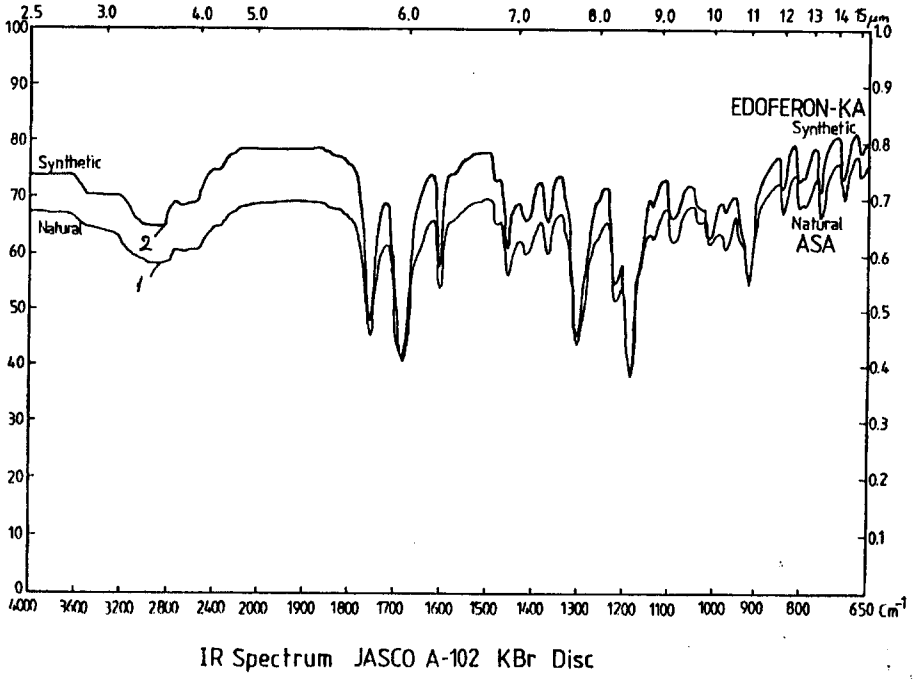

Fig.3. The IR transmission spectra of the samples obtained by usual technology (curve 1) and under laser radiation effect (curve 2).

3. CONCLUSION

Thus, the investigations have shown that the Helix AK-1 samples obtained under the laser radiation are stable paramagnetic compounds. The studies of the photoluminescence spectra and the dependence of transmission coefficient of the sample on the wave-lengths have not revealed great difference between samples obtained by traditional methods and the laser radiation. This fact can be considered as the evidence of identity of chemical composition of samples obtained in different technological conditions. The obtained results allow concluding that the laser radiation effect is responsible for the change of the electron spectrum leading to the stabilization of the sample in a paramagnetic state.

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[3] *E. Buyukkoca.* EPO 90313579.6-2107.

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HELIX AK-1 BİRLƏŞMƏSİNİN STABİL PARAMAQNETİZM HALINDA FİZİKİ-KİMYƏVİ XASSƏLƏRİ

HELIX AK-1 birləşməsi sintez edilmişdir. Göstərilmişdir ki, lazer şüalarının tə'siri ilə alınmış nümunələr stabil paramaqnetizm xüsusiyyətinə malikdir. Elektron paramaqnit rezonansının (EPR) spektrlərinin tədqiqi spin-orbital qarşılıqlı tə'sirinin əsaslı olduğunu göstərmişdir. Alınmış nümunələrin elektrik və dielektrik xassələri (290-340) K temperatur intervalında öyrənilmişdir. (0.3-0.6) mkm intervalında alınmış nümunələrin lüminesensiyası və buraxılma spektrləri tədqiq olunmuşdur.

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ФИЗИКО-ХИМИЧЕСКИЕ СВОЙСТВА HELIX АК-1 В СТАБИЛЬНОМ ПАРАМЕТРИЧЕСКОМ СОСТОЯНИИ

Синтезированы образцы соединения HELIX АК-1. Показано, что образцы, полученные при воздействии лазерного излучения, обладают стабильным парамагнетизмом. Исследованы спектры ЭПР, которые указывают на значительный вклад спин-орбитального взаимодействия. Изучены электрические и диэлектрические свойства образцов в интервале температур (290-340 К). Исследованы спектры люминесценции, а также пропускания образцов в интервале длин волн (0.3 - 0.6) мкм.

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