

GAS-CORE SYNTHESIS COMPOUNDS INTERCALATION OF GRAPHITE WITH FeCl₃ AND MATERIALS ON HIS BASE

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Introduction

Recently, investigation of graphite intercalation compounds (GIC) with transitional metals chlorides attracted much attention. These compounds possesses interesting structure (regulate lamellar structure characterized by highly anisotropy of properties), that makes these compounds ideal object for studying two-dimensional state physics and chemistry.

Besides, GIC with transitional metals compounds has practical application as raw material for obtaining exfoliated graphite, containing metallic inclusions.

Results and discussion

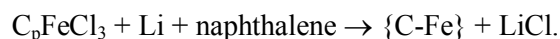
Samples of I and II stages GIC with FeCl₃ were synthesized by gas-core method in two-unit ampoules. Highly oriented pyrolytic graphite was used as initial material. Synthesis was carried out in gradient furnace: temperature of FeCl₃ was the same in every experiment and equal to 300°C. To synthesize compounds with different phase composition temperature gradient was changed. It should be noticed, graphite temperature always higher than FeCl₃ one. Experimental results are listed in table. X-Ray and synchronous DTA-DSC analysis of obtained GIC was carried out. X-Ray measurements showed that period of identity are 9,40Å for the I stage and 12,78Å for the II stage, that is in good agreement with [1].

GIC stability in different mediums: air, H₂O, HNO₃, HCl was studied. GIC with FeCl₃ at the air

medium starts decompose after a week, and accompanied by appearance of graphite besides initial stage phase. Interaction between GIC – FeCl₃ and 98 % HNO₃ leads to TGIC formation. GIC – FeCl₃ is stable in HCl medium: even long treatment does not influence on phase composition of compound.

The possibility to obtain exfoliated graphite with high expansion degree during thermal treatment was shown.

Reduction of GIC - FeCl₃ by reaction with lithium –naphthalene– tetrahydrofuran system was investigated. It was shown, that reduction of Fe³⁺ leads to formation of graphite, doped by iron cluster.



Conclusions

Highly regulated samples of GIC - FeCl₃ at I and II stages were synthesized and their physical-chemical properties were investigated.

The possibility of obtaining of exfoliated graphite, possessing magnetic properties was shown.

References

1. Solozhenko V.L., Kalashnikov Ya.A. Sintez and fiziko-khimicheskoe issledovanie SSG s FeCl₃. – Vest. MGU. Khimiya, 1981, t.22, №6, str.591-596.

Table 1. Results of GIC – FeCl₃ gas-core synthesis.

gradT, °C	τ, h	Δm, %	N (I _c , Å)	Composition
10	18	207.0	I (9.39)	C _{6.6} FeCl ₃
	25	225.5	I (9.41)	C _{6.0} FeCl ₃
60	3	42.2	II (12.72)	C _{32.1} FeCl ₃
	25	112.9	II (12.81)	C _{12.0} FeCl ₃