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MAGNETITE NANOPOWDERS AS A SORBENT FOR OIL EXTRACTION FROM THE WATER SURFACE

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The paper discusses the application of magnetite nanopowders obtained by mechanochemical synthesis for sorption of oil spilled in water, in particular, the sorption of mineral oil (MBP grade, GOST 1805-76).

Mechanochemical synthesis of magnetite nanopowders was performed according to the reaction:

$$FeSO_4 \cdot 7H_2O + 2FeCl_3 \cdot 6H_2O + 8NaOH = Fe_3O_4 + Na_2SO_4 + 6NaCl + 23H_2O$$

Powders were synthesized in an AGO-3 planetary mill (60 g acceleration) for 30 min with a ratio of the reaction mixture to the inert component sodium chloride equal to 1:2.

The experimental procedure for studying the ability of magnetite nanopowders to sorb mineral oil on the water surface corresponds to [1]. Magnetite particles were removed from the surface using a magnet.

The gravimetric method and thermogravimetric studies were used to assess the ability of magnetite nanopowders to sorb mineral oil. The amount of oil was determined on VK-600 electronic scales with an accuracy of 0.01 g, measuring the mass of oil with pre-weighed magnetite nanopowder after its removal from the aqueous medium. It was found that the magnetite nanopowder sorb about 42 wt % of mineral oil.

According to thermogravimetry, magnetite nanopowders concentrate a significant amount of oil (Fig. 1). The oil combustion occurs in the range from 250 to 420 ^{0}C with intensive heat emission (exothermic peak at 379 ^{0}C). The exothermic effect in this temperature range corresponds to a large mass loss on the TG curve (Fig. 1), which determines the amount of oil retained by the nanopowder.

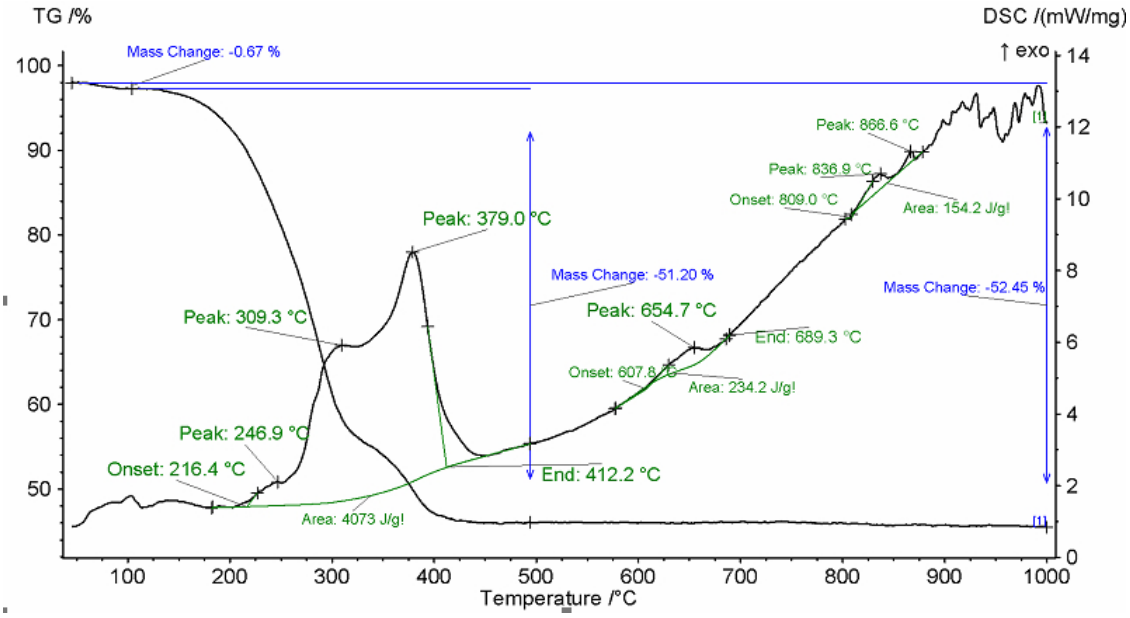

Figure 1. Thermogravimetric analysis of magnetite nanopowder with sorbed mineral oil.

The results showed the possibility of using ferrimagnetic nanopowders obtained by mechanochemical synthesis as materials for the sorption of oil products. It is known that for nanosized particles the surface area-to-volume ratio is very high, and the agglomeration process is thermodynamically favorable. It can be assumed that mineral oil is sorbed by weakly bonded agglomerates of magnetite particles with large porous space, which traps mineral oil under the action of capillary forces.

REFERENCES

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