Electrosurface properties of magnetic Laponite RD®

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Aims: Synthesis and characterization of NM and LapM; electrosurface properties of materials.

Materials: nanomagnetite (NM), Laponite RD® (Rockwood Additives Ltd., UK) (Lap), magnetic Lap (LapM).
NM was synthesized using the Elmore method. LapM was prepared by mixing the aqueous suspensions of NM and Lap. The concentration of NM at suspensions was fixed at 0.75 wt.% and concentration of Lap was varied in the range of 0.0375–1.5 wt% (with mass ratio $X_m=m_{NM}/m_{Lap}$ varied in the range of 20.0 - 0.5).

Characterization: transmission electron microscopy (TEM); X-ray phase analysis, dynamic light scattering (DLS) and electrokinetic measurements (ZetaSizer Nano ZS instrument (Malvern, United Kingdom)).

NanoMagnetite (NM)

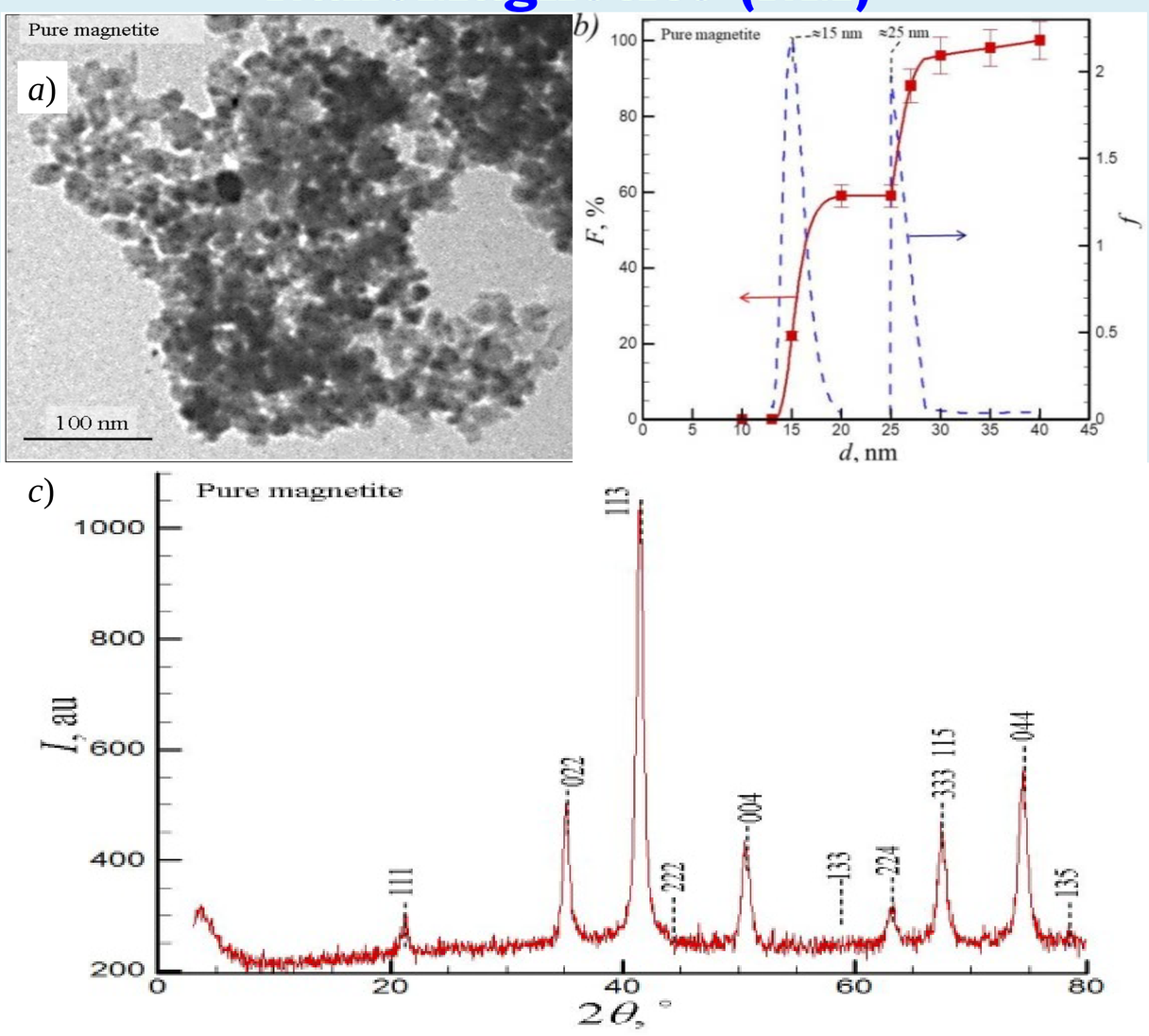

Fig. 1 *a*) TEM image. Average diameter of NM, *D*~19.8 nm; *b)* Integral, *F*, and differential, *f*, size distribution functions *c) X*-ray: phase composition – 100% NM, Fe_3O_4 (Fd3m) with lattice parameters a=b=c=0.84 nm and average diameter - *D*~20 nm

ζ-potentials of NM, Lap and LapM

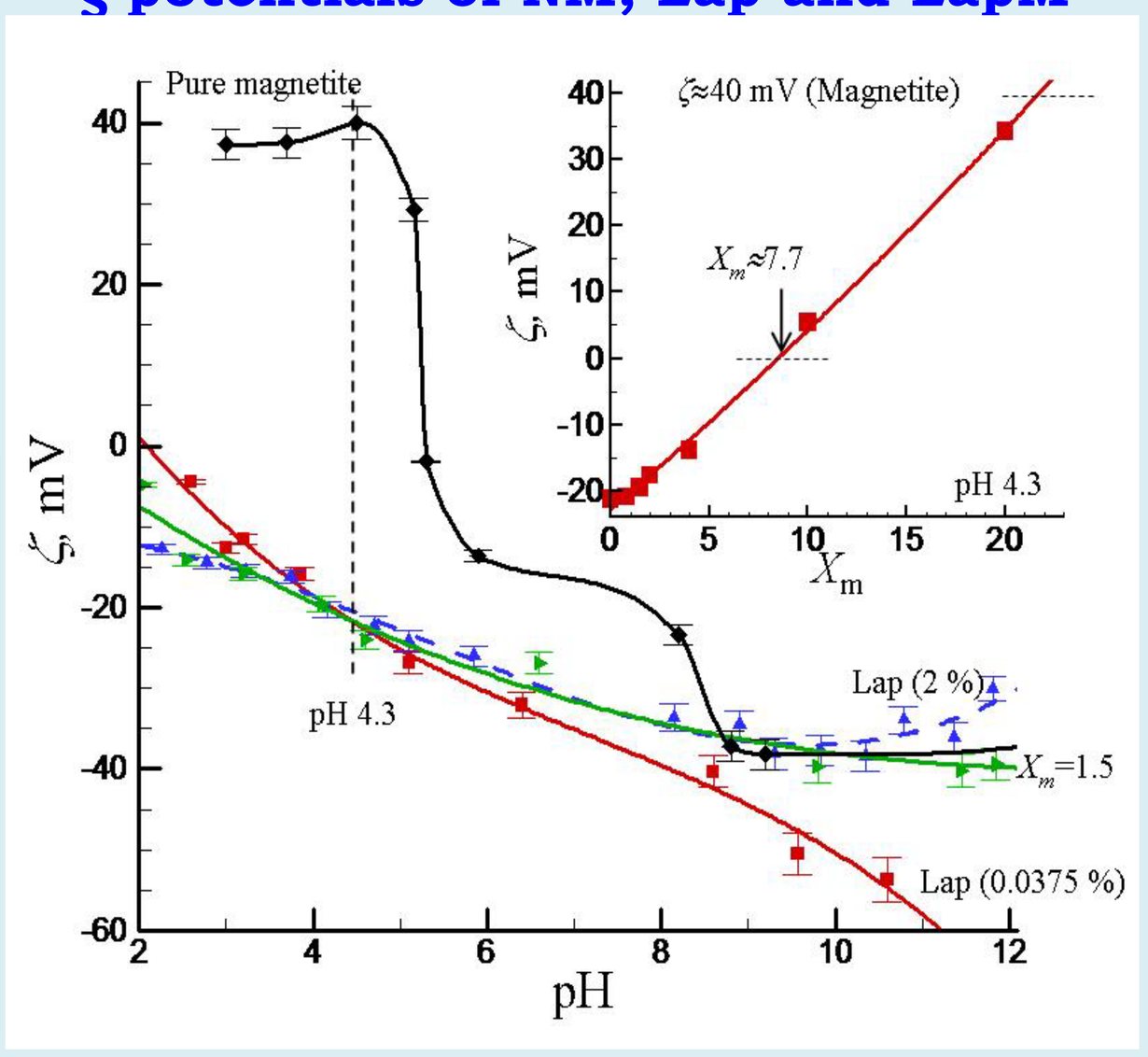

Fig.3 ζ-potential vs pH for NM, Lap and LapM

Magnetic Lap (LapM)

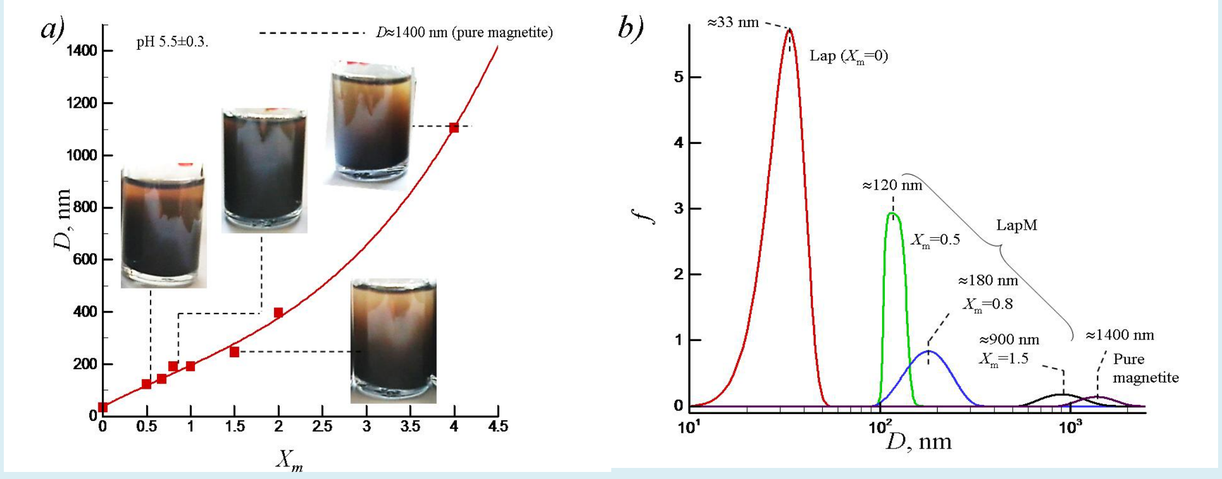

Fig. 2 *a)* The size of the aggregates LapM, *D*, with different mass ratio X_m for particles dispersed in aqueous medium. Photo of LapM suspension 24 h after its preparation. Experimental data are indicated by [■]. *b)* Differential function of LapM size distribution for different X_m. Data obtained at pH=const=5.5±0.3.

Conclusions

- NM consists presents a 100% magnetic phase of Fe_3O_4 with size of the particle of *D*~20 nm. Isoelectric point (IEP) is observed at pH 5.2.
- LapM with mass ratio X_m<7.7 exhibits high negative ζ-potential (pH 2-12) which was close to that Lap.
- For LapM pH 4.3 (Fig.3, insert) the following behavior is observed

1) at high content of NM (X_m≥20) ζ-potential approaches to the value ζ-=+40 mv characteristic to the pure NM;
2) Increase in concentration of NM results in increase of ζ-potential of LapM and IEP was observed (ζ-potential changes from positive to negative value) at X_m~7.7.

- Observed variations in the ζ-potential reflect the hydrophobic and electrostatic interactions between magnetite and Lap.

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