

Atomic Force Microscopy in the ferrofluid microstructural investigation

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To get various details regarding the ferrophase dimensional distribution the classical TEM investigation may be supplemented with alternative methods able to offer different views on the size and shape of nanoparticle matter. We used two Atomic Force Microscopy (AFM) devices to obtain 3-D data concerning the ferrophase particles and particle agglomerations, three ferrofluids being studied: two water-ferrofluids and one oil-ferrofluid, prepared in our laboratories on the basis of coprecipitation of ferrous and ferric ions [1-2]. The tapping mode was chosen in both AFM devices, the radius of the scanning tip being of 5-10 nm. Ferrofluid samples have been prepared on mica support following convenient dilution.

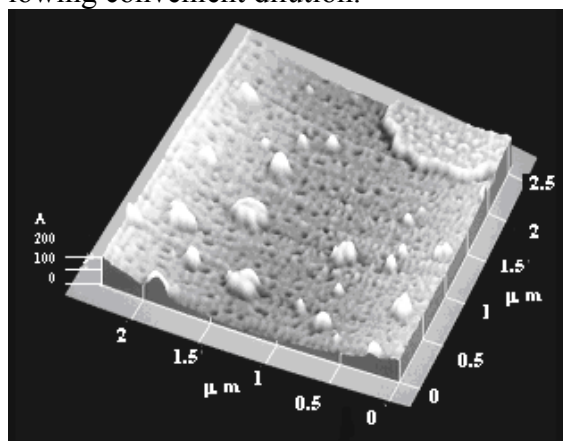


Figure 1: AFM image on water-ferrofluid

The investigation aimed to compare data provided by 2-D, 3-D and phase images that enable us to discern between single particle and aggregates and chains based on the diameter but also on the height of the topological details of the scanned area. Histograms have been built and average diameter values have been computationally extracted (less than 10 nm in all samples) that revealed the dominance of small size particles, in co-existence with low percent-

age of large aggregates but very few short chains.

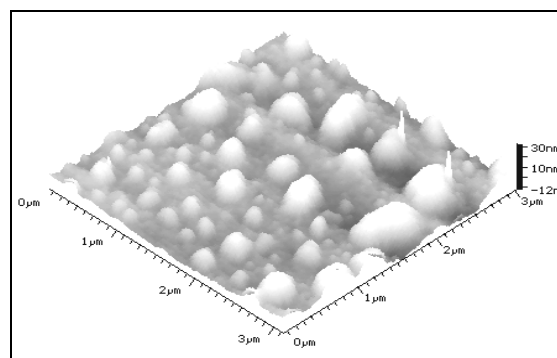


Figure 2: AFM picture on oil-ferrofluid

In parallel TEM investigation was carried out for adequately prepared samples of the three studied ferrofluids (using Tesla device) similar distributions being evidenced as in the case of AFM data. The consequences of the dimensional features on the stability of the investigated ferrofluids have been discussed in relation with the ferrofluid destination – biological and medical applications [3].

References

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