Final Report

Project acronym: *FMF*

Project number*: 1.1.1.5/ERANET/18/04*

M-ERA.NET Call 2017

Period covered: 03/09/2018 to 02/09//2021

Refer to beneficiaries when filling out this report.
To be completed by the project coordinator only.
Minimum font size is 11 pt.

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2. Publishable project summary

The project was focused on several topics in the field of magnetic soft matter- filaments, their dynamics and flow field around them, suspensions of magnetic particles. The synthesis of flexible ferromagnetic filaments is carried out and from the study of their deformation in a rotating field their physical properties – magnetization per unit length, bending modulus were experimentally determined. New phenomenon found in these experiments was transition to the three dimensional regime of motion when the frequency of the rotating field is larger than a critical for a synchronous regime. Hypothesis about the structural instability caused by the flexibility of the filament was formulated. Interesting consequences of the flexibility of ferromagnetic filaments follow for the frequency dependence of the magnetic susceptibility of the chains of magnetosomes of magnetotactic bacteria confirmed experimentally. The mechanism of the self-propelling motion of the ferromagnetic filaments was predicted theoretically and confirmed experimentally. These results were published in the Nature Portfolio journal. As a follow up study new methods for the numerical simulation of flexible magnetic filaments were developed on the basis of the lattice Boltzmann algorithm.

Important aspect of the project consists in the study of ensembles of magnetoresponsive particles driven by external fields. Here a new phenomenon of swarming of hematite particles under the action of rotating field were predicted and experimentally confirmed. Interesting features have the ensembles of active particles which can synchronize their motion under the action of the rotating field.