FERROGELS BASED ON COMMERTIAL MICROPARTICLES OF MAGNETITE OR STRONTIUM FERRITE

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For different cancer diagnostics or/and therapies the detection of the magnetic particles (MPs) incorporated into living tissues is requested. At the same time their studies have certain restrictions for testing by physical methods coming from variety of interconnected complex processes, which exist in the living matter. To minimize this uncertainty one can use model materials, which reproduce the selected features of the living systems. Ferrogels (FG) with MPs can be used as a model material reflecting the main properties of the living tissue.

In this work, gels and FGs with a polymeric network of polyacrylamide were synthesized by radical polymerization of monomeric acrylamide (AAm) in water solution at three level of concentration: 1.1 M, 0.85 M and 0.58 M providing gels with varying elasticity. Micron sized magnetic particles (content varied from 0 up to 5.2 wt %) of commercial magnetite and strontium hexaferrite were used as fillers. To improve FGs biocompatibility and to prevent the precipitation of the particles, polysaccharide thickeners (guar gum or xanthan gum) were used. The magnetic and mechanical properties of FGs and their deformation in a uniform magnetic field were comparatively analyzed.

FGs filled with strontium hexaferrite particles have larger value of the Young modulus than FGs filled with magnetite particles. FGs networks with xanthan are stronger and have higher modulus than the FGs with guar networks. In case of the magnetite series, the contraction trend of FGs in a magnetic field prevails in all compositions. At the same time, the influence of polysaccharides does not follow the trend in modulus. The saturation magnetizations of the FGs showed a linear dependence on the magnetic filler concentration.

Small magnetic field magnetoimpedance (MI) biosensor prototype with $Co_{68.6}Fe_{3.9}Mo_{3.0}Si_{12.0}B_{12.5}$ rapidly quenched amorphous ribbon was designed and successfully tested for the measurements of the concentration dependence of MPs in gels/FGs. Finally, the main result is ability to create such model samples mimicking natural tissue that they can be viewed as reliable substitute for living systems.

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