A NEW BIOMEDICAL PERSPECTIVE AND APPLICATIONS OF CAST AMORPHOUS MICROWIRES ON ELECTROMAGNETIC SHIELDING

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We present the results of a research regarding new applications of cast amorphous microwires in the realization of some new composite material and the possibility to use it in electromagnetic shielding and protection equipment manufacturing. The composite material and the technical problems raised by its manufacturing technology are described [1 – 6], and its shielding, rejection and polarization properties are evaluated.

The search for materials exhibiting outstanding properties in high frequency range is thus relevant in the development of those applications. In this article, we focus on a particular family of materials, glass-coated amorphous magnetic microwires, exhibiting exciting microwave behavior with enormous technological applications in particular fields: as elements for absorption of electromagnetic radiation from medical engineering .

Before entering into their microwave properties, let us briefly summarize some important aspects of these composite materials. Glass-coated magnetic microwires are characterized by a nucleus out of a magnetic alloy, structurally amorphous and metallic conductor, with diameter between around 2 and 20 μm, covered by a Pyrex-like coating 2 to 10 μm thick. They are fabricated by a particular rapid solidification technique, sometimes called quenching and drawing method, following the early Taylor technique later modified by Ulitovsky [5 – 8]. That coating, besides insulating the metallic nucleus from corrosion and electrical points of view, induces strong mechanical stresses in that nucleus [5, 6] that couple with magnetostriction to determine large magnetoelastic anisotropy, and consequently a unique magnetic behavior. Particularly, the strong magnetoelastic anisotropy in magnetostrictive Fe-rich alloys amorphous microwires gives rise to the existence magnetic bistability characterized. These microwires exhibit also outstanding high frequency properties as for example natural ferromagnetic resonance, NFMR, [4 – 8] appearing typically within the frequency range 0,1 to 12 GHz depending on the magnetic alloy composition.

The technological use of high and ultra-high frequencies in medical engineering has led to the need of creating electromagnetic protective screens. The above mentioned amorphous microwires can be thus employed as radio-absorption elements when embedded in suitable matrix [1 – 4]. The equipment was used such that to ensure mechanical protection, to perform the shielding function in electromagnetically polluted environments. The microwave electromagnetic response has been analyzed for a composite consisting of dipoles of amorphous magnetic glass-coated microwires in a dielectric. This material for medical engineering can be employed for radio absorbing screening. The spontaneous *NFMR* phenomena observed in glass-coated microwires has opened the possibility of developing novel materials with broad-band of radio absorbing materials.

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