problem of the timber knot structural characteristics influence on the concrete strength. The mathematical model of this connection has been developed [3].

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INFLUENCE OF LOW FREQUENCY MAGNETIC FIELD ON THE ENVIRONMENT AND ON THE OBJECTS OF BIOLOGICAL NATURE

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Bioelectromagnetics is a relatively new area of science that deals with the interaction of electromagnetic energy with biological systems. Therefore, studies usually are carried out jointly by researchers from both biological/medical sciences and engineering/physical sciences: expertise in both areas is necessary.

All living organisms evolved on a giant magnet, the one called “Earth”. The strength of the geomagnetic field is about 40 μT. The earth’s magnetic field is quasi-static, varying only slightly with time and location. Natural static electric fields, under clear sky conditions are about 0.1 kV/m on the earth’s surface, field strengths of up to 30 kV/m are reached under clouds producing lightning.

In addition to these naturally existing electromagnetic fields, we live in an artificially created electromagnetic environment. Most commercial electrical systems operate at either 50 or 60 Hz. Electrical and electronic devices operating at this “power frequency” - such as hair dryers and refrigerators - are in everyday use. Furthermore, many of our daily activities are conducted near, and sometimes under, high-voltage transmission lines and lower-voltage distribution lines.

Even though the use of electricity began more than 100 years ago, the possibility that exposure in our daily activities to the electric and magnetic fields produced by various types of electrical equipment and facilities might have previously unrecognized adverse health effects. This topic has been a subject of concern, beginning about 1975.

At low frequencies, the electric and magnetic field components are independent, meaning there is no true electromagnetic field, as occurs at much higher frequencies. At these high frequencies, the electric and magnetic fields are coupled to each other, so there truly is an electromagnetic field. However, it has become the practice to talk about extremely low frequency (ELF < 300 Hz) “electromagnetic fields”. This phrase often is used indiscriminately to mean electric field, magnetic field, or electric plus magnetic field. Reluctantly, this text will follow the conventional practice and will, on occasion, use the phrase electromagnetic field in an ELF context.

Research on possible electromagnetic field effects on biological systems originated primarily from four different ‘sources’. One focus was an interest in basic neurophysiological function: the nervous system is fundamentally an electrical system. This area began with Galvani and Volta in the early 19th century, when they had their famous controversy about electrical stimulation and contraction of the frog legs. The second focus began in the 1930s among scientists interested in the effects of microwave irradiation on plant cells, animal sarcoma cells, and other targets. The third area was clinical and therapeutic study of the application of electric and magnetic fields to bone fractures: sometimes fractures do not heal properly, and application of currents or fields appears to promote healing. This success has led to an interest in other therapeutic applications. The fourth motivation was based on public concern about and scientific interest in possible adverse health effects. This area was triggered largely by the Soviet Union’s governmental decree on electric workers in 1973. Because of concern about ill defined health effects, an occupational exposure standard was promulgated at field strength far lower than what was considered hazardous in Western countries. Both public concern and scientific interest were strengthened by the epidemiological work of Wertheimer and Leeper (1979), who reported a possible association of power-frequency magnetic fields and childhood leukemia.

Although the former three research areas have been continued steadfastly by scientists and clinicians in each area, the fourth area has been studied most energetically in the last three decades, involving epidemiologist, engineers and scientists from around the world. Furthermore, as cell phones were adopted world-wide in the 1990s, similar concerns and research approaches were applied with these devices, which have much higher frequencies, such as 2 GHz in the newest phones.

During last few years, a great interest was demonstrated to the Smart Materials which are materials that react quickly to a stimulus in a specific manner. Smart Materials modify their physical properties (shape, color, stiffness, conductivity) in a controlled way under external stimulus (temperature, pH, stress, electric/magnetic fields). The external stimulus is converted to mechanical energy. The change in the material can also be reversible, as a change in stimulus can bring the material back to its previous state.

Shape memory alloys (SMA) are metals that exhibit pseudo-elasticity and the Shape Memory Effect (SME). The basic principle behind SMA is that a solid state phase change occurs in these materials. They switch between states of Austenite and Martensite. A material, previously deformed in Martensite (the low temperature phase) - recovers its original shape, when heated up to the Austenite - the high temperature phase. The martensitic transformation occurs across a given range of temperature.

Biological Applications of SMA include Bone Plates (memory effect pulls bones together to promote healing), Surgical Anchor (as healing progresses, muscles grow around the wire; this prevents tissue damage that could be caused by staples or screws), Clot Filter (does not interfere with MRI from non-ferromagnetic properties), Catheters, Retainers, Eyeglasses.

Having in mind all said above, in the present study we investigated an influence of low frequency magnetic field on the SMA and on objects of biological nature.

Samples. Metal samples fabricated by melting in argon atmosphere in induction furnace. Some of the metal samples were heat treated by annealing at 1170 K for 24 h and subsequent water quenching. Biological samples have been prepared at the Department of Biochemistry at the University of Basque Country.

Measurements. Composition of metal samples and possible changes of the biological samples structure have been determined using EDX analysis on Scanning Electron Microscope (SEM). M (T) measurements of low field magnetization have been performed using in-house made Vibrating Sample Magnetometer (VSM), at temperatures 130 K - 440 K and magnetic field 100 Oe. Magnetocaloric measurements using Mettler-Toledo Differential Scanning Calorimeter have been performed to study possible effects of magnetic field induced heating on metals and biological objects. Quantum Design PPMS system (Thermal Relaxation technique) was used with temperature range 10 K - 570 K and fields up to 9 Tesla.

Some experimental results for low field magnetization of metal samples are shown in Figure 1.

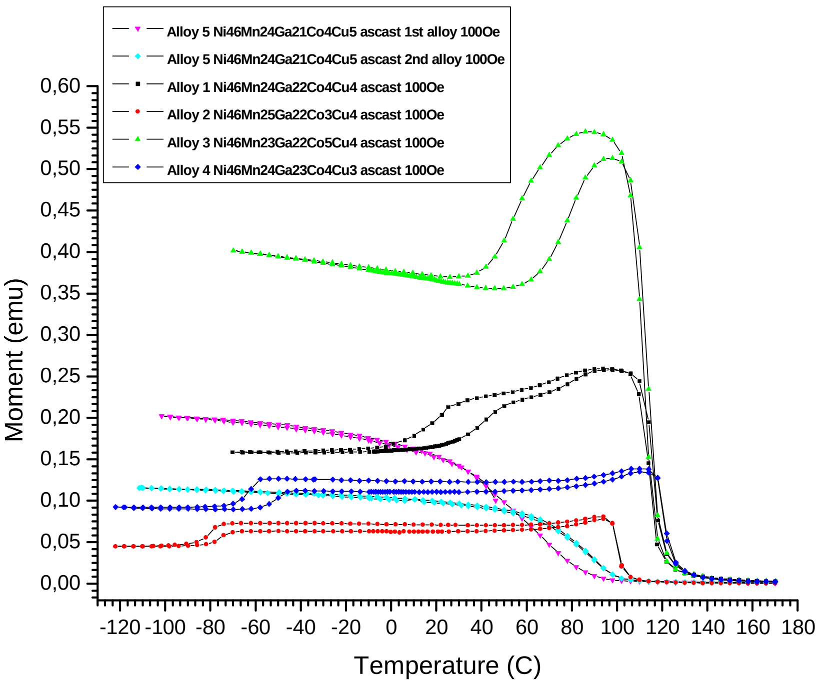

Figure 1. M (T) dependencies of low field magnetization

As a conclusion it should be noticed that application of low magnetic field leads to the changes of structure and properties of metal and biological samples and for biological objects such changes often dramatically influencing the way of organism functioning.

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MODELING OF PROCESSES OF MECHANICAL INTERACTION IN DISCRETE-CONTINUUM COMPLEX "TRAM -TRACK OVERHEAD STRUCTURE"

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The paper investigates the interaction of the tram to the rail in the area of isolated irregularities butt. Considered the transport of the complex mechanical "train