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RESPONSE TO DC EXCITATION BINARY ZrCu SYSTEMS

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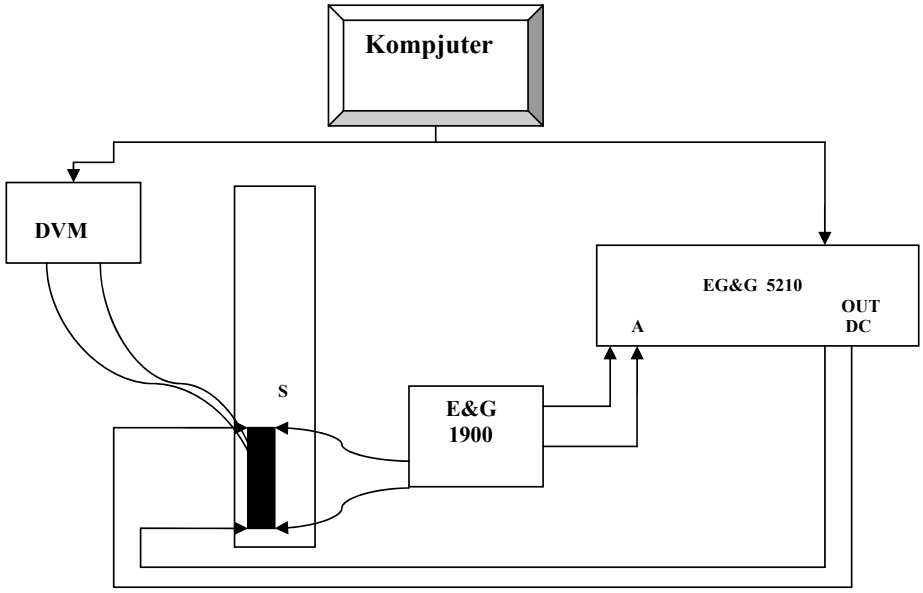
ABSTRACT
In this paper make a comparison of monitoring relaxation processes in binary ZrCu systems through changes imaginary component of magnetic susceptibility depending on temperature and the system response to dc excitation depending on the temperature of the system. The goal was to determine the applicability of dc excitation tracking relaxation processes in amorphous metal systems.The advantage of this method in comparison to watching the changes of magnetic susceptibility on temperature amorphous systems is that the system may not be in a vacuum, and the possibility of monitoring the relaxation processes to room temperature of system.The research is fundamental, i.e. belongs to physics of the solid state. The obtained results are presented graphically.
Keywords: Amorphous Metallic Alloys, ac Susceptibility, ac Excitation

1. INTRODUCTION
In paper [1] the change of magnetic susceptibility of binary ZrCu systems depending on the temperature of the samples is observed. Each peak in the graphic related to just mentioned dependence represents the transition from one metastable state to another, and in that way it is possible to track the relaxation processes in the amorphous metal systems. The experiment conditions determined the temperature interval from 77 K to 195 K. The sample was in vacuum, and related to the quality of the achieved vacuum it could have been warmed up.
The idea was to check if the relaxation processes in amorphous metal systems could be tracked if the measuring is being done in four points. DC voltage is being brought to the two points on the sample, as shown in Fig.1, and the response of the system to DC excitation is being measured from the other two points. Then, the comparison of dependence of imaginary component of magnetic susceptibility for the same systems within the same temperature intervals was being made. The dependence shows the change of the energetic stability of the systems observed as a function of the temperature and the response of the system to DC excitation.
Resistance of amorphous metal systems is being changed by warming up the samples and accordingly the response of the system which represents the decrease of the voltage at the ends of the samples.
DC excitation was voltage of *1V*, and order of magnitude output voltage was 10^{-3} *V*.
In this way it is possible to track the relaxation processes in the paramagnetic and diamagnetic systems. This method does not give the possibility to identify the phase transitions of second degree; transition of the system from ferromagnetic to paramagnetic state, and therefore it is not possible to examine ferromagnetic systems with this method. The advantage of this method is that the system does not have to be in vacuum, and temperature interval, in which the relaxation process is observed, is larger and it goes from 85K to 295K. The limitation of 295K is the software by which the whole experiment is controlled, and it allows the measurement of the output voltage at the sample warmed up to the room temperature.

2. EXPERIMENT

In laboratory of physic of metals at the Natural-mathematical faculty in Sarajevo the alloys Zr35Cu65 (Zr: 35 at.%; Cu: 65 at.%), Zr40Cu60 (Zr: 40 at.%; Cu: 60 at.%), Zr49Cu51 (Zr: 49 at.%; Cu: 51 at.%) were produced in vacuum electric arc furnace in argon atmosphere. Then the amorphous tapes were produced from that alloys using melt-spinning method [2]. Dependence the response of the systems on the temperature is tested very sensitive method which is shown in Figure 1: EG&G 5210 lock-in amplifier –is used as a source of ac signals having voltage 1V and current of 1mA, then as a source of dc voltage from 1V to 15V and as an instrument for measuring of output voltage signal from sample with sensitivity from 3V to 1nV, DVM-Keithley – instrument for measuring voltage with a precision up to the sixth decimal of the temperature, EG&G 1900-transformator – amplifier which amplifies a signal from 10 to 1000 times, working frequency is 28,4Hz, S – sample.



Slika 1. Shematski prikaz sistema za mjerenje odziva uzoraka na dc pobudu u ovisnosti o temperaturi

3. RESULTS

The figures 2,3,4,5,6 and 7 are showing the results of the measurements. Conclusions are made based on those results.

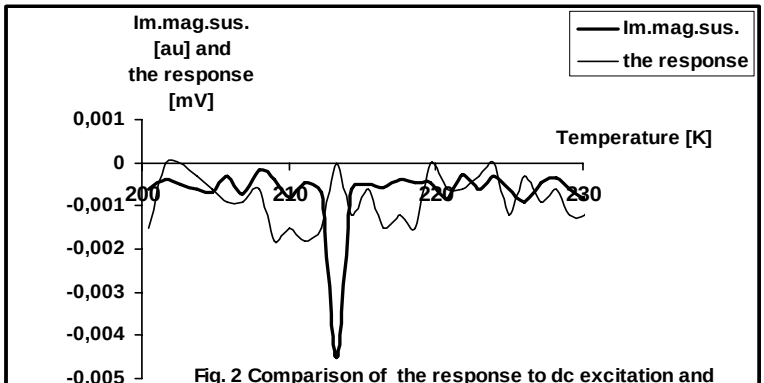


Fig. 2 Comparison of the response to dc excitation and imaginary components of magnetic susceptibility depending on temperature amorphous Zr49Cu51 system

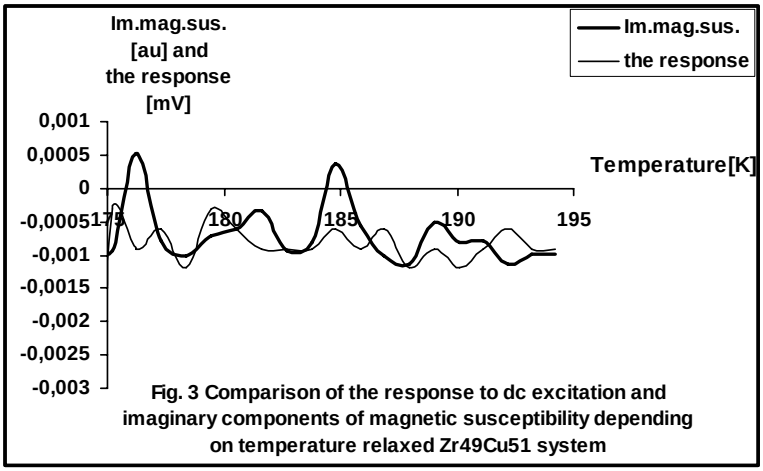


Fig. 3 Comparison of the response to dc excitation and imaginary components of magnetic susceptibility depending on temperature relaxed Zr49Cu51 system

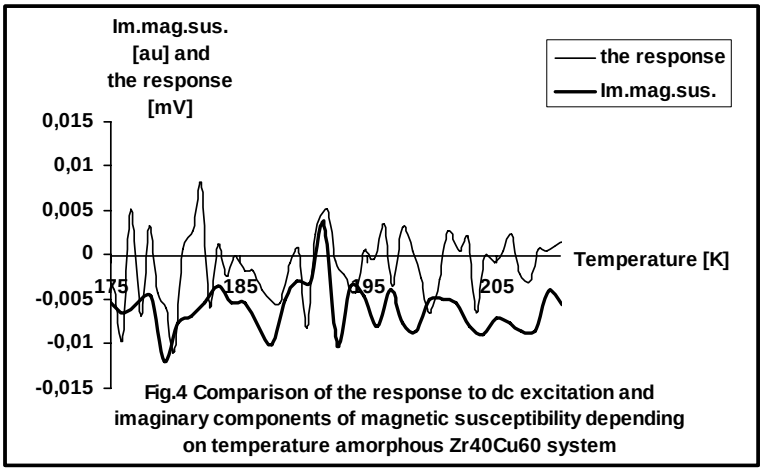


Fig.4 Comparison of the response to dc excitation and imaginary components of magnetic susceptibility depending on temperature amorphous Zr40Cu60 system

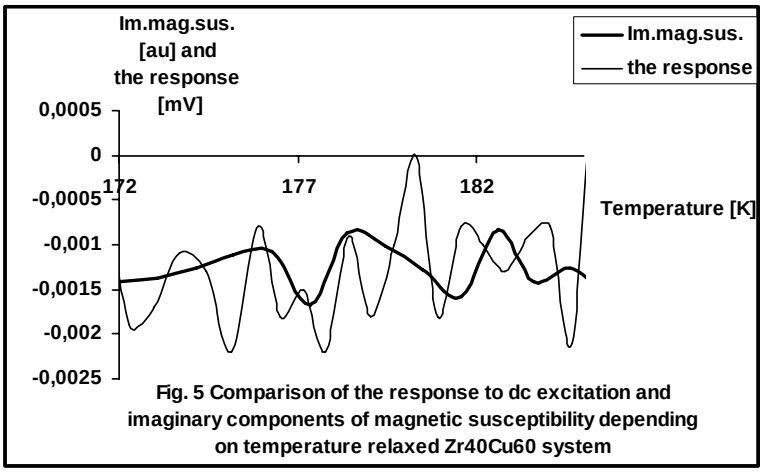


Fig. 5 Comparison of the response to dc excitation and imaginary components of magnetic susceptibility depending on temperature relaxed Zr40Cu60 system

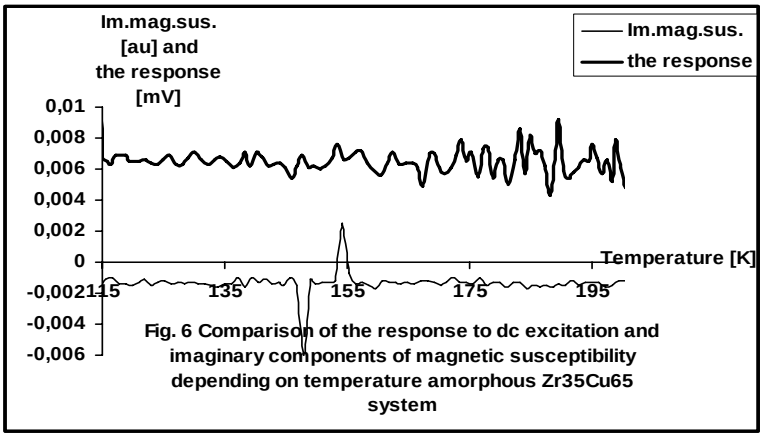


Fig. 6 Comparison of the response to dc excitation and imaginary components of magnetic susceptibility depending on temperature amorphous Zr35Cu65 system

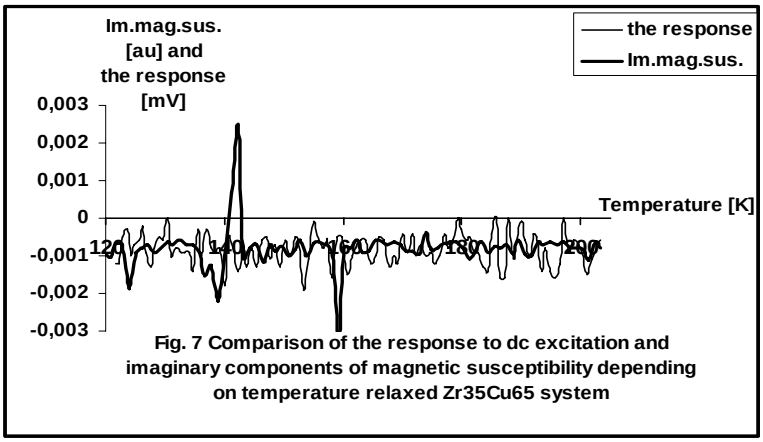


Fig. 7 Comparison of the response to dc excitation and imaginary components of magnetic susceptibility depending on temperature relaxed Zr35Cu65 system

4. CONCLUSIONS

1. Based on the results which are shown in figures 2,3,4,5,6 and 7, it could be concluded that the relaxation processes for paramagnetic systems can be tracked using dc excitation of the amorphous systems.
2. Tested systems kept part of their amorphous structure even after being annealed. This is confirmed by the change of magnetic susceptibility with the change of temperature.

5. REFERENCES

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