

Project title: Researches on the achievement of ecologic technologies based on magnetostrictively induced vibrations with a view to reducing the energy consumptions having as effect the global warming

Phase no.: 1 Theoretical studies regarding the stress relief method

Planned objectives:

- Theoretical studies on the stress relief method
- Study on the achievement of mechanical vibrators using Giant Magnetostrictive Material. Constructive solutions
- Solutions for supplying the magnetostrictive vibrators
- Initial referential

Activity description:

Activity I.1 Study on the decrease of internal stresses by controlled mechanical vibration stress relief

The mechanical characteristics have two fundamental components: functional resistance and dimensional stability in time, the two components being conditioned one by another.

The dimensional stability is assured by the resistance to wear and by the condition of unstable residual stress. These unstable residual stresses lead to cracks and to dimensional changes of the parts. The problem is to remove as far as possible the unstable internal stresses, without affecting the stable residual stress state.

The decrease of remanent stresses at vibration is carried out by creating stresses variable in the part. The part vibrates at resonance frequency, for certain duration, depending on certain characteristics of the part. By vibrating, the latent energy of the force fields determined by internal stresses is activated, accelerating the process of re-arranging the atomic plans (dislocation displacements) and dissipating the internal energy of the material. One can say that an accelerated or artificial ageing of the material occurs.

Got results: Study – 1 pc.

Stage of achieving the planned objective/finalization form (of the activity within the phase):

The planned objective was achieved and finalized as “Theoretical study on the vibratory stress relief method”

Activity I.2 Study on the achievement of mechanical vibrators by using Giant Magnetostrictive Materials. Constructive solution.

The physical principle of magnetostrictive vibrators is based on the magnetostriction phenomenon, which is characteristic to ferromagnetic materials. Magnetically, the polycrystalline substance is considered to be composed of many magnetic domains, very small ones, with randomly distributed magnetic moments. Within each domain, separately considered, the magnetic moments of the atoms are oriented towards the same direction, different from the direction of the neighboring domains. On the whole, the ferromagnetic body is magnetically neutral.

In the presence of the outer magnetic field, the re-distribution of the magnetic moments of the domains occurs in the ferromagnetic body, having as result the increase of the magnetization state of the body. Because an energy re-distribution takes place in the magnetic domains, dimensional changes appear in material, i.e. its deformation. There is a linear magnetostriction, where the change of geometric dimensions is produced in the direction of magnetic field application, also a volume magnetostriction, where the geometric dimensions of the body change in all directions. The linear magnetostriction is produced in weak fields, on the unsaturated part of the magnetization curve. The volume magnetostriction is produced in higher fields and corresponds to the saturation part of the magnetization curve.

Got results: Study – 1 pc.

Stage of achieving the planned objective/finalization form (of the activity within the phase):
The planned objective was achieved and finalized as „Study on the achievement of mechanical vibrators by using Giant Magnetostrictive Materials. Constructive solutions”

Activity I.3 Solutions for supplying the magnetostrictive vibrators

Within this activity, the model SIMULINK of vibratory stress relief equipment was carried out.

Got results: Study – 1 pc.

Stage of achieving the planned objective/finalization form (of the activity within the phase):
The planned objective was achieved and finalized as „ Solutions for supplying the magnetostrictive vibrators”

Activity I.4 Drawing up the initial referential

Within the framework of this activity, the company standard “Vibratory stress relief equipment with magnetostrictive vibrator” was developed. The constructive and functional characteristics were set, the description of the equipment structure and operation was presented, and the technical quality conditions, rules for verifying the quality necessary to be met by the stress relief equipment were established.

The planned objective was carried out and finalized as company standard “Vibratory stress relief equipment with magnetostrictive vibrator”

Got result: Company standard – 1 pc.