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THE STUDY OF TRIBOLOGY PROCESS AT LEVEL OF FRICTION COUPLES

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Abstract: At frontier between solids mechanics and fluids mechanics has formed a new science "tribology", defined like"science and technology of surface interactions in relative motion and of results application.
The friction researchs, wear and lubricating by their complex nature require beside solid body mechanical and lubrication and other science domains: crystallography, strength of the materials, thermotechnics, surfaces physico-chemical, molecular chemistry and of the lubricants, lubrication systems.

1. INTRODUCTION

At frontier between solids mechanics and fluids mechanics has formed a new science "tribology", defined like "science and technology of surface" interactions in relative motion and of results application.

The friction researchs, wear and lubricating by their complex nature require beside solid body mechanical and lubrication and other science domains: crystallography, strength of the materials, thermotechnics, surfaces physico-chemical, molecular chemistry and of the lubricants, lubrication systems.

2. THE IMPORTANT FACTORS WHICH DETERMINE THE TRIBOLOGICAL PROCES

In the present article will put accent on friction process and friction couples, in tribological conditions.

In the tribology process the important thing is the material quality, the surfaces quality in contact, lubricant quality and lubrication system.
For the test of the material, lubricant quality and lubrication system must make a testing stand type FZG, with closed circuit which allow the determination of wear behaviour in different loading conditions on gravimetry way.

This bench-stand is prezented in fig. 1, with the following components:

- direct – current motor (1);
- motor gearing (2);
- torsion shaft (3);
- coupling for torgue measurement (4);

- work gearing (5);
- loud coupling (6);
- closed shaft (7)

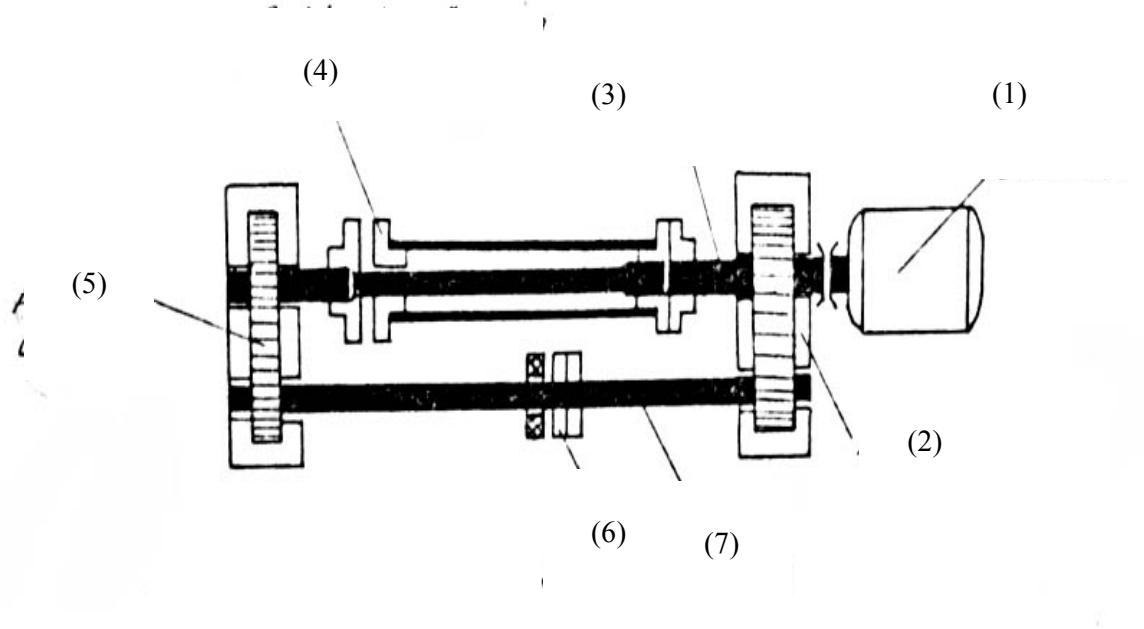

Fig. 1 - Testing stand with gears type FZG, with closed circuit of load force

For the choose of friction couple material must respect conditions:

-very good thermic conductivity;
-rezistance to wear or thermic effects;
-elasticity modulus reduced.

Characteristics which condition the surface interactions of two couple material in friction have a big importance regarding tribology and we can splited them in two categories :

- Volumic characteristics, as creep stress, hardness, modulus of shearing G, elastic modulus, material parameters which denote brittleness or tenacity of material, thermal caracteristics etc;
- Surface characteristics, as chimical reactivity or the tendince for development on surfacing course with diferent chimical compositions, tendency to absorbtion of chaine molecules from environmental, free surface energy and compatibility of two surfaces in contact term of interfacial energy.

A important aspect, which must to be mainly in attention in tribological process are presented shortly in tabel 1 and fig. 2 and 3, is pertinent to lubricants and friction regime, functional properties of lubricant oil and interactions of choice parameter of lubricant.

Tabel 1 Lubricant and friction regime

Friction regime Clearance	Rugosity	Speed / Load	Film typ	Couple of frication characteristics
Limit (L)	Very small	Small/ heavy	Two or more absorbing molecular or chemichal-absorbing beddings; continual or break films	Bolt-bolt nut, slide bar, contacts, mechanical bearings, gearings etc.
Mixed (M) (semifluid)	Small, average	Small/ heavy	Molecular break beddings and break bulk films areas	Slide bar, piston – cylinder, bearings HD, gearings etc.
Elasto-hidrodynamic (EHD)	Very small	Average, big/ Heavy	Thick film, continual, self-supporting, which very high viscosity, elastical croocked clearance	Gearings, rolling contact bearings, cam-cam lever, speed variators EHD,
Plasto-hidrodynamic (PHD)	Very small	Average, big/ Heavy	Thick film, continual, self-supporting, which very high viscosity, elastoplastycal croocked clearance	Hypo-gearings hipoide, rolling contact bearings si speed variators EHD heavy loaded, cold drawing dies.
Transition (mixed typ) partial EHD, TEHD, PHD, HD, THD, MHD, PHS, GD, MGD.	Small, average and big	Average, big/ Heavy	Thick film, continual, self-supporting, which very high viscosity (EHD, TEHD, PHD), average and small (HD, THD, MHD, PHS), very small (GD, MGD).	Gearings, rolling contact bearings, speed variators heavy loaded (EHD, TEHD, PHD), slide bearings heavy loaded and low speed (HD, THD, MHD), contact sealing (PHS), gas-bearings (GD, MGD) etc.
Hydrodynamic (HD)	Small, average	Average, big/ Small, average	Thick film, continual, self-supporting	Slide bearings (radial, axial) for machine tools, electrical motors, turbine etc.
Magneto hydrodynamic (MHD)	Small, average	Average, big/ Small, everage	Thick film, continual, neconventional (MHD)	Slide bearings nuclear reactoars
Hydrostatic (HS)	Small, average	Very small, average/ Heavy	Thick film, continual throught external pressure	Slide bearings (radial, axial) for machine tools, chemical equipment, etc.
Gasostatycal (GS)	Small, average	Average/ average	Thick film, continual (air, gas) throught external pressure	Slide bearings (radial, axial) for machine tools supercentrifugal equipments, sliders, refrigeting machines.
Carryng hybrid (HS-HD) and (laminar-turbulent flow)	Small, average	High/ Small, average, high	Fluid film continual, throught external pressure and self-supporting; with self-supporting in area of neconventional fluides	Slide bearings (radial, axial) for machine tools, chemical equipment etc., turbine, nuclear reactors, flow throught pipes

In fig. 2 [nd] are presented the functional properties of lubricant oils for choosen

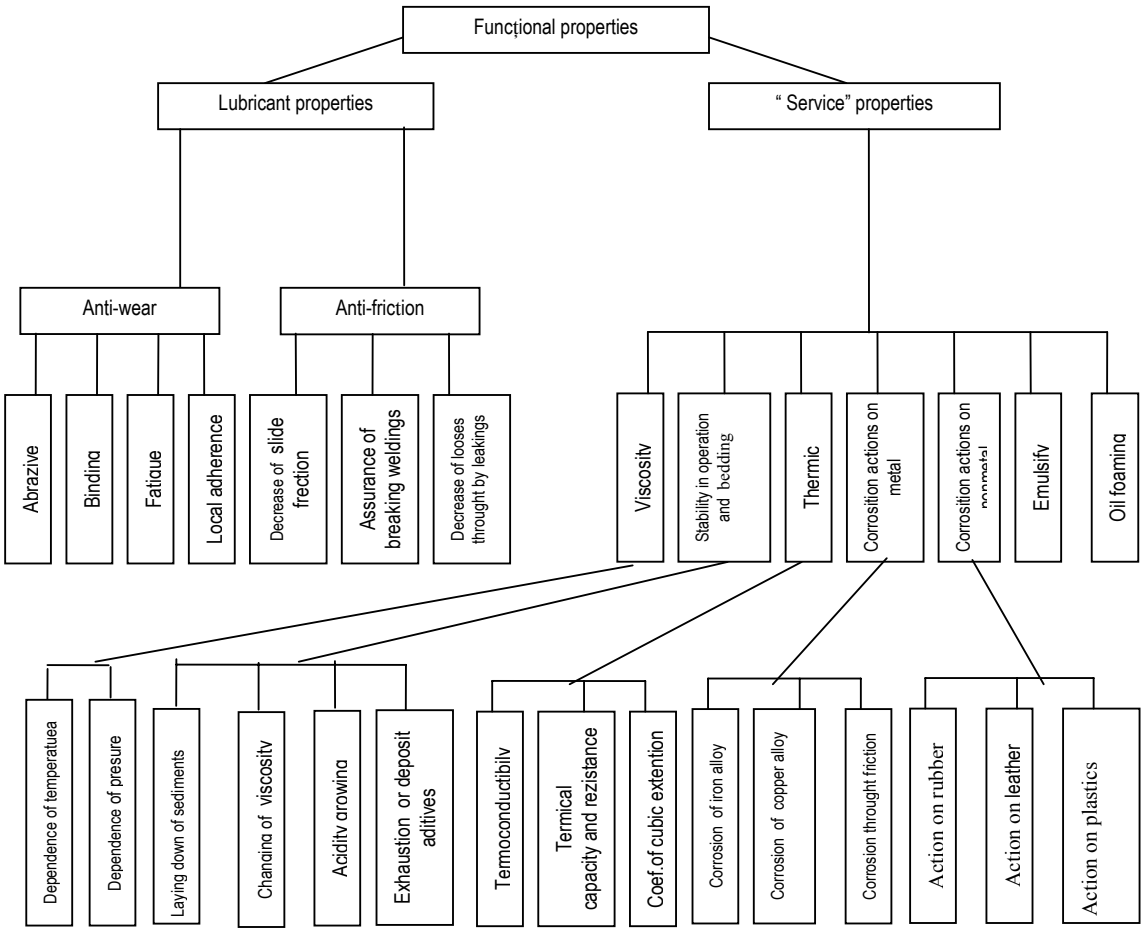

Fig. 2. Functional properties of lubricant oil

In fig. 3rd is preesented the choosen reason for lubricants depanding of interaction of technico-functional parameters

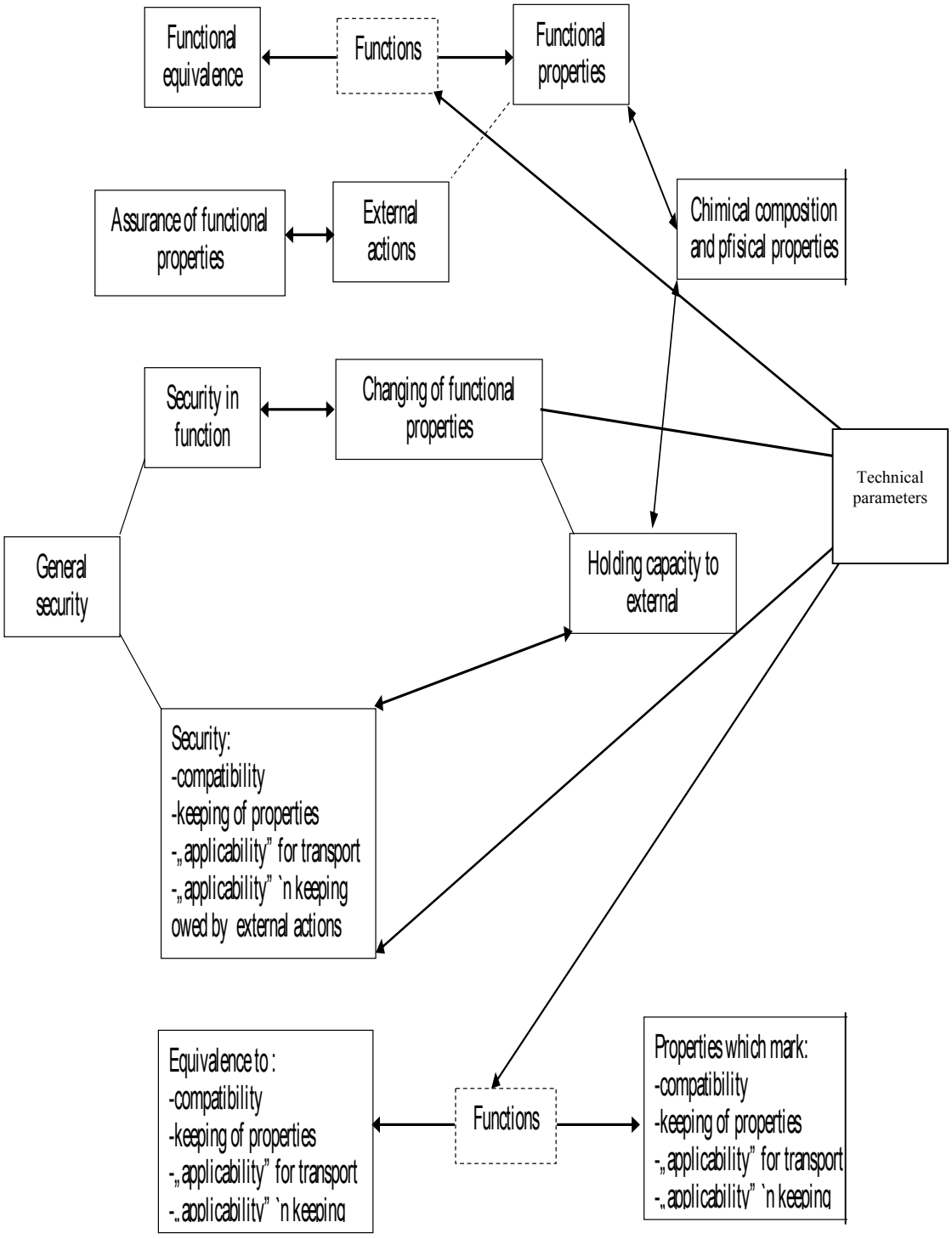

Fig. 3 Interaction of parameters for choosing a lubricant

3.CONCLUSIONS

Tribology as a science has a multidisciplinary character, but the most important aplicativ side is tribotehnica.

Mainly contributions carried by tribology as science, consist in new theory, new laws and principles, new design methodologies and aplications, for getting positive effects.

Regarding about new theries we can mentioned :

- New theory friction (adhezive, quantium-energetics, electrostatical);
- New theory of wear;
- New theory of lubricate;

Regarding of new materials, we can mentioned :

- ferrous and non-ferrous, with new friction characteristics;
- plastics, selflubricants, sintereds, compounds (with new antifriction characteristics)
- new surface treatments ;
- two or thre bedding surfaces.

Regarding about experimental and calculation methodology, we can mention new calculation methods (analitical, numerical, statistical), utilized new experimental technicalx (back reflection and electronics, electronical microscopy, electronical microsonde, radioactive tracers, laser).

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