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SIMUNTANEOUSLY MEASUREMENT OF DMA AND RCL CHARAKTERISTICS

J. Šišáková, M. Mokryšová
Faculty of Industrial Technologies,
I. Krasku 491/30, 020 01 Púchov,
Slovakia, kucerova@fpt.tnuni.sk

František Šišák
PSL, a. s,
Robotnícka ulica, 017 01 Považská Bystrica,
Slovakia

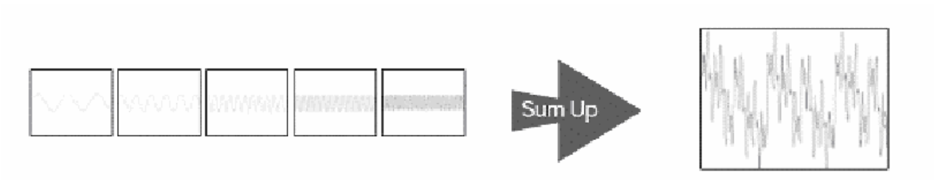
ABSTRACT
Experimental work deals with influence on dynamic – mechanic properties and electric properties of various rubber blends. Composition of compared blends is different in filler ratio. One of blend has silica filler, the second one has carbon black filler and the third blend is a combination of previous abilities [1]. Measured characteristics make interesting values of dynamical, mechanical and electrical parameters.
Keywords: DMA, RCL, rubber sample, characteristics

1. INTRODUCTION
Vulcanized caoutchouc mixture – rubber is one of important material of construction and production. Especially its elastic properties were influence its high concurrency in technical praxis. The whole term- “rubber” isn’t so exactly than “steel”, because the boundary of physical – mechanical properties are so widely.
Examination of dynamical – mechanical and electrical properties of rubber blends has very important place in rubber technology, when we appreciate these properties with examination of metals in machine industry.
Dynamical mechanical analysis has high predicative value because there is only in one experiment the complex information about dependency of mechanical properties vs. temperature, frequency of cyclic deformation. There are a lot of polymeric materials which are deformed / driving tires, curves on a road…/. The majority of cracks on the constructed mixtures are fatigue fractures which are influenced by some vibrations and there are only no static loaded constructions in praxis. Nowadays are “in” especially the methods of rubber examination: dynamic – mechanical properties. The significance increased with the appearance of some reasons vs. practical properties of rubber products.
In a case on investigation of dynamic properties is good to make other investigation – the investigation of electric properties. We will have good information about the behaviour of rubber blends.
In this paper are separately measurements of DMA /dynamical mechanical analysis/ and RCL meter properties /electrical characteristics/ and in the finishing evaluation are compared this both characteristics by dual measurement of dynamical and electric properties only on the one rubber sample.
The goal of these measurements is made appreciate of influence of composition of same blends on dynamical-mechanical properties.

2. EXPERIMENTAL PART

With Diamond DMA which is seen on figure 1 is possible to measure multiplex frequency operations and synthetics oscillation mode – figure 2. This experimental technique can realize multiplex frequency experiments in time duration of dynamical heating by relatively high velocities (5°C/min.). In case of synthetics oscillation mode is stress concentration – sinusoidal wave is applied on sample and this one contains five frequencies. An advantage of this multiplex frequency and synthetic oscillation of DMA experiments that we can achieve more information about sample and its characteristics.

Figure 1. Diamond Dynamic mechanical analyzer (DMA)



5 frequencies applied frequency packet on one sample

Figure 2. Scheme of synthetic oscillation mode with five applied frequencies

SAMPLE PREPARATION AND COMPOSITION

a) there is a thin plate with dimension about 2mm of the second stage of mixing
b) then is cut a plate of 150 x 150 mm
c) plate is press down by assigned curing time and temperature
d) samples are in "relax time" about 16 hours
e) testing sample is cut in accord with figure 3, 4

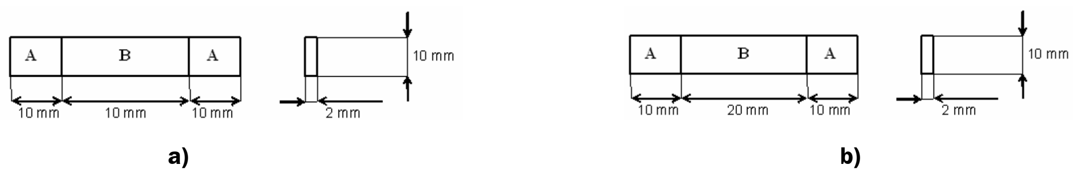


Figure 3. Dimension of sample for static a) and dynamic b) measurement.

A - clamping face part, B – working part

Sinusoidal oscillation – frequency dependence by constant temperature

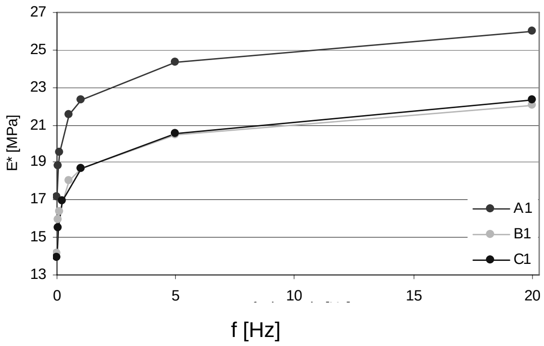


Figure 4. Dependency of complex modulus vs. frequency

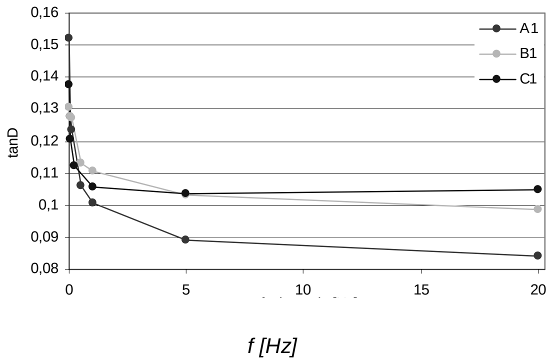


Figure 5. Dependency of loss angle vs. frequency

Synthetic oscillation; f = 1Hz

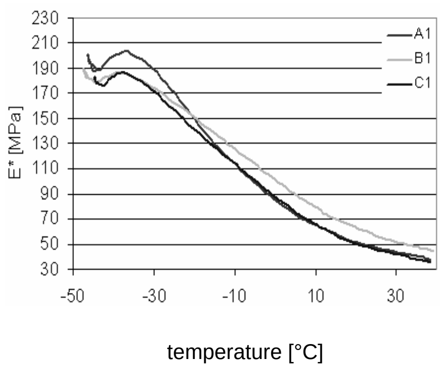


Figure 6. Dependency of complex modulus vs .temperature

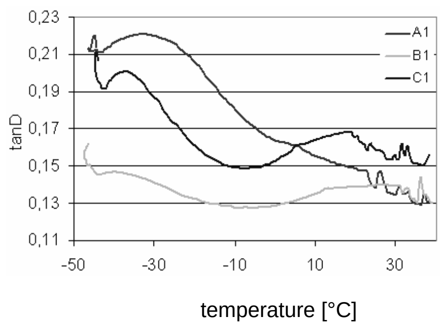


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Figure 7. Dependency of loss angle vs. temperature.

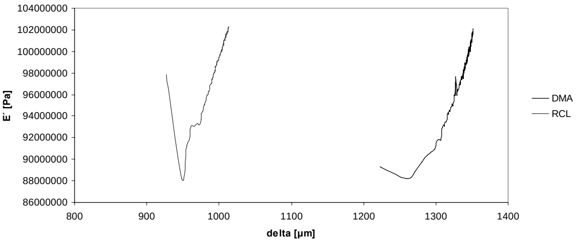


Figure 8. Dependency of E´ vs. displacement

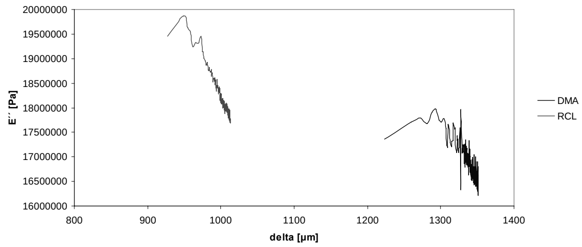


Figure 9. Dependency of E´´ vs. displacement

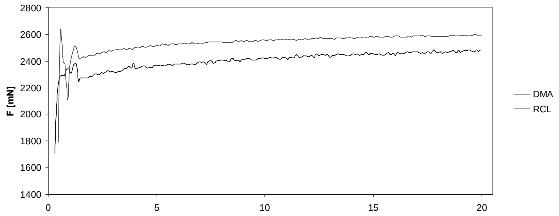


Figure 10. Dependency of force vs. time

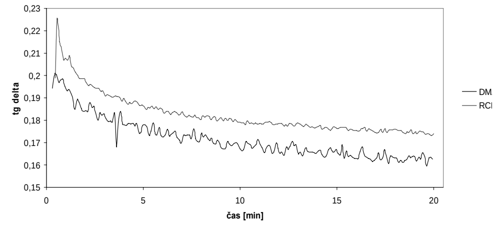
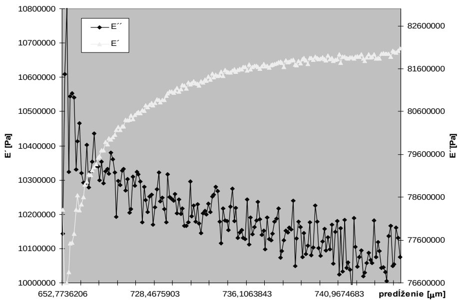
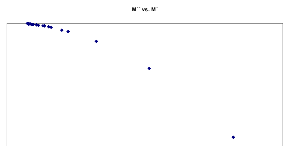
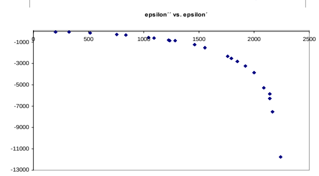


Figure 11. Dependency of loss angle vs. time

f=50Hz







3. CONCLUSIONS

Goal of this work was to compare dynamic-mechanical properties and electric properties. In experimental part were written laboratory technique, possibilities of measurements and evaluation of the individual samples. At the finish of experimental work is sign of possibly simultaneously measurement of DM properties and electrical properties. The chosen method was developed at Institute of Material and Technological Research. These results are sensible for frequency change, but the method is in term of development – results are good and promising for confidence more information about investigate sample. For evaluation of rubber samples A,B and C we can say that the best properties has rubber sample "A" for its good results of sinusoidal oscillation and synthesis oscillation.

4. REFERENCES

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