DEVELOPMENT OF MR FLUID FOR A RUNNING SHOES WITH A ACTIVE DAMPING SYSTEM

[1]Giordano Franceschini, [1]Francesco Mastrandrea and [1]Vanessa Carnevali
[1]Industrial Engineering Department, Perugia University,
email: carnevali@mec.dii.unipg.it , web: www.dii.unipg.it

INTRODUCTION

The sporting shoes in particular those for running must fulfil two requirements: to one side they must assure the maximum utilization of the biomechanical energy, on the other side they must avoid that the athlete incurs in functional overload pathologies due or to isolated use or cause by repeated microtraumas in the time [1,2]. To satisfy these conditions materials or devices able not only to reduce the maximum values of the impact strength but also absorb the micro-vibrations [3]. The damping cannot being otherwise excessive because negatively affects the athletic performance. Therefore there is the necessity to reach a compromise between two opposite demands, this can be outdated using the smart fluids able to modify in real time the damping coefficient according to the necessities of the athlete.

METHODS

We have prepared in our laboratories different MRF mixtures and then we have tested them to detect the best one for our purpose. For the rheometric analysis of the MRF mixtures and their basic elements (oil and lithium grease), we have used a rotational viscometer Brookfield and a rheometric expansion system (Ares). The study of carbonyl-iron particles was carried out through *Field-Emission Scanning Electron Microscope* (FESEM).

RESULTS AND DISCUSSION

Of all the mixtures that we have analysed , that one show the best characteristics for the realization of an active damping cushioning system for sports shoes is the MRF manufactured with 50 g of Ford gear oil (75W-90 BO), 10 g of Lithium white grease and 150g of carbonyl-iron powder (MRF-ford 50+10) each 100 ml.

In Figure 1 we can see the trends of MRF-ford 50+10 and MRF-lord in the isotherm test (DTimeSwp) as a function of magnetic field.

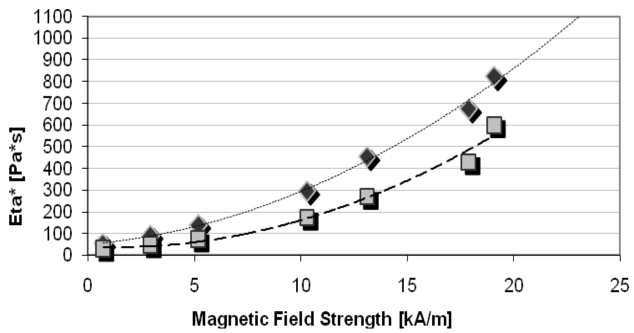


Figure 1: Evolution of viscosity Eta * as a function of magnetic field of the MRF-Ford 50+10 (◆) and MRF-lord (■)

The figure 2 shows the comparison (DFreqSwp), dependent on rotational frequency, among the frequency response of storage modulus G', loss modulus G" and ETA* viscosity with and whiteout magnetic field, using the MRF FORD 50+10. It's possible notice that G' and G" and ETA* are very sensitive to magnetic field while G and G' increase with frequency. The storage modulus magnitude G' can reach 6028,42 Pa with this current I= 0,1 A (10,705 kA/m Magnetic field strength) and with a frequency of 100 rad/s, while without the magnetic field, G' is 836,52 Pa and the loss modulus G" has the same tendency.

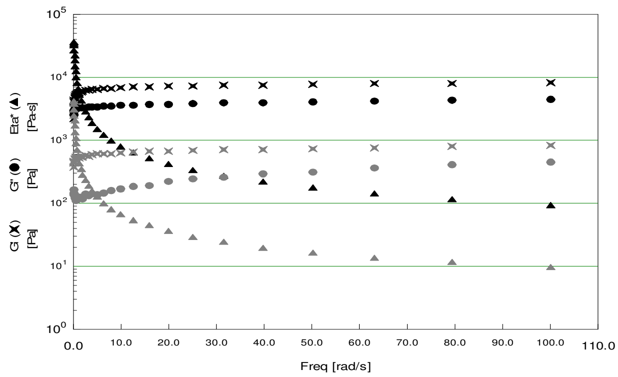
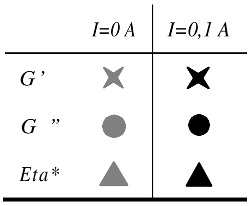


Figure 2: how the storage modulus G', loss modulus G", and ETA* viscosity depends on rotational frequency and intensity of current.



CONCLUSIONS

The next target will be to solve some doubts about the duration, the power system, and best way to manage the MRF inside the shoes.

The path to realize an active damping system for running shoes is still long, anyway this first test is good step for a possible practical application.

REFERENCES

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