Use of infrared thermography to describe reinforcement during natural rubber fatigue test

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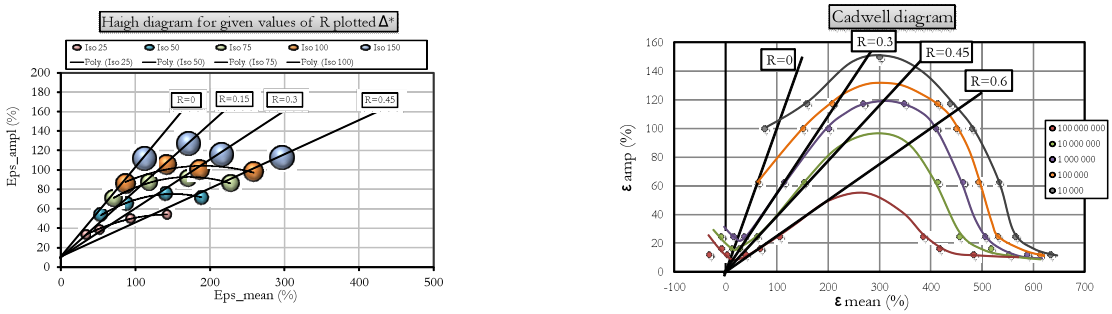
In the automotive industry, antivibration parts designed with natural rubber undergo complex fatigue loadings, and notably loads with a positive minimum value which drives to a so called reinforcement phenomenon usually related to strain induced crystallization. An example of these parts is multi links bushes with high level of swaging.

Parallely, heat build-up measurements are nowadays a rising methodology to characterize fatigue properties of metallic or elastomeric parts. It is used notably in [1].

We propose in this paper to examine the correlation between the so called reinforcement for R>0 and the corresponding heat build-up tests on an hourglass shaped sample. Indeed, IR thermography allows us to observe clearly phenomena at the skin of the samples with heat source terms. Moreover, we already know that the reinforcement is characterized by multi crack branching, which appears at skin also[2].

First results are really promising (**Figure 1**), because we observe with infrared thermography the same tendencies than the famous diagram obtained by Cadwell[3], that's to say a reinforcement until a given threshold and then the vanishing of this phenomenon, in a really reduced amount of time (2 or 3 days of tests).



a) Haigh diagram from IR tests *b) Cadwell diagram*

Figure 1: Trends comparison between Haigh diagrams plotted in terms of intrinsic dissipated energy (a) and strain like for the Cadwell diagram (b)

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[3] CADWELL, S. MERRILL,R. SLOMAN, C. & YOST, F. "Dynamic fatigue life of rubber" *Industrial and Engineering Chemistry* **12** (1940) 19-23