Compositional analysis of rubber from pneumatic tires

INTRODUCTION

TGA is frequently used to determine the content of polymers, rubbers, elastomers, and related materials with regards to their plasticizers/oil, polymer content, carbon black filler content, white filler content, and residual content. Indeed, as TGA measures the elastomer's weight loss under programmed temperature and atmosphere conditions, it provides an indication of its composition and of its thermal stability.

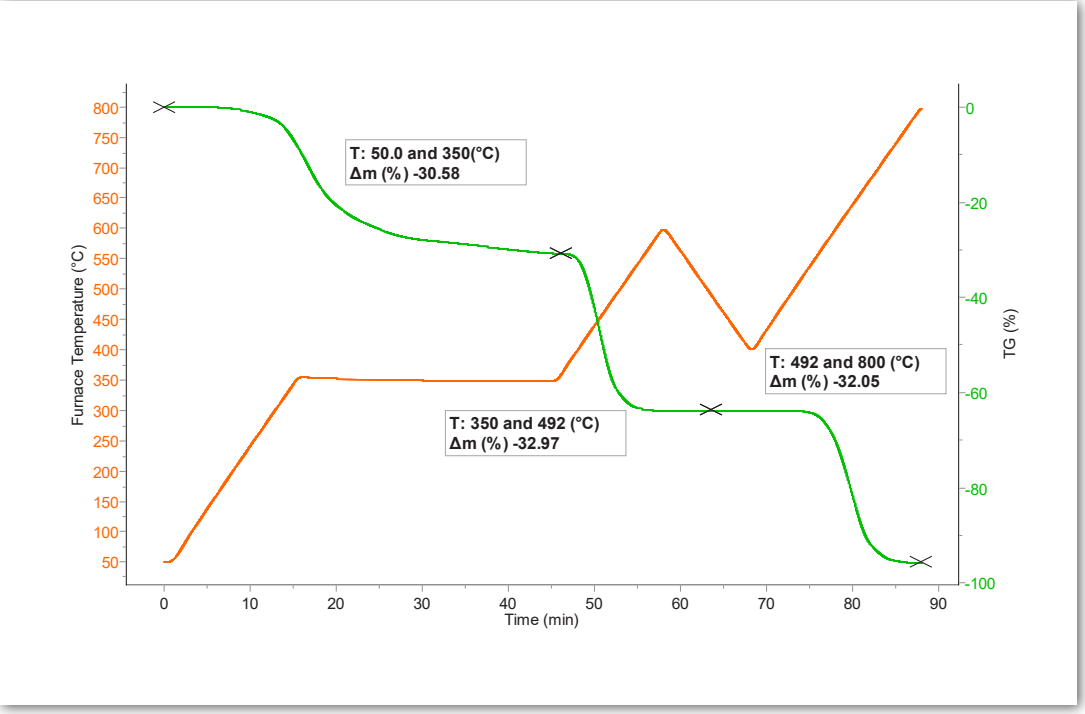
EXPERIMENT

SETLINE TGA was used to determine the amounts of organics (oil, polymer), carbon black and ash (filler) in a rubber sample extracted from a tire. The test was performed firstly under nitrogen to decompose the organic matter and then under oxygen to burn the carbon content.

The following experimental procedure was used in the presented example:

- A small piece (15 mg) of the tire elastomer sample was placed into an alumina crucible
- A nitrogen flow rate (30 ml/min) was applied
- The sample was heated from 50°C to 350°C at 20°C/min
- It was stabilized at 350°C during 30 minutes
- It was heated from 350°C to 600°C at 20°C/min
- It was cooled down to 400°C at 20°C/min
- Nitrogen was switched with air (30 ml/min)
- The sample was heated from 400°C to 800°C at 20°C/min

RESULTS AND CONCLUSION



For the investigated tire material, three mass losses were observed, all corresponding to the decomposition of a fraction of the rubber.

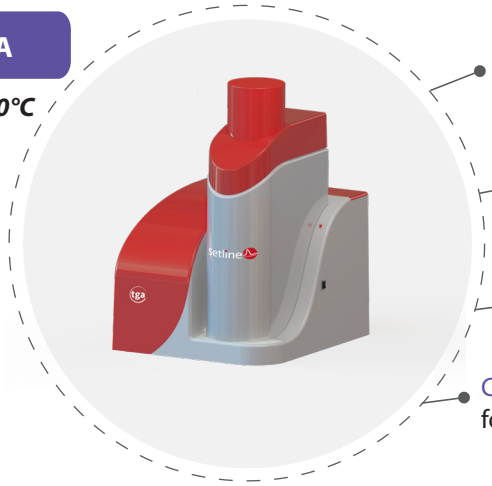
Temperature range	Atmosphere	Decomposing fraction	Content
50°C to 350°C	Nitrogen	Plasticizer, oil, and wax	30.58%
350°C to 600°C	Nitrogen	Elastomer	32.97%
400°C to 800°C	Air	Carbon black	32.05%

The remaining mass at the end of the experiment corresponds to the ash content (including fillers) of the sample: 4.4%.
Setline TGA is very well adapted for the investigation of the decomposition of polymeric materials and especially for their compositional analyses.

INSTRUMENT

SETLINE TGA

Ambient to 1100°C



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