

Background

Natural rubber is a sensitive material for degradation compared to metal and inorganic materials. To protect natural rubber from chemical and physical attacks, many chemicals are added in rubber molding step. The combination and amount of chemicals play an important role in life time of rubber product. Consequently, to estimate degradation degree was important for related industry and FT-IR (Fourier transform-infrared spectrometry) analysis has been used. The DART[®]-MS analysis is the direct ionization source, solids and liquids are ionized in atmospheric pressure directly. And the ionRocket is the temperature rising device for DART[®]-MS analysis. By using the ionRocket, a broad range of molecular compounds are able to detect in one run: From the small molecular compounds to high molecular compounds. In this report, ionRocket DART[®]-MS (Direct Analysis in Real Time- Mass Spectrometry) analysis was applied to analyze the degraded rubber band and compared the result with the FT-IR analysis.

Samples

Rubber band (commercial item)

Methods

The rubber band was treated at 130°C for 30 min. The sample was cut by razor into 0.5 mm x 0.5 mm and put onto the pot, sample stage. The temperature was raised by the ionRocket from room temperature to 600°C by 100°C /min. The total run time was about 7 min.

Results

The result of FT-IR by ATR (Attenuated Total Reflection) method was shown in Figure 1. In general, C=C bond of main chain of the natural rubber was decreased, on the other hand, >C=O was increased after heat degradation. However, in this method, there were no distinct differences.

By ionRocket DART[®]-MS analysis, the result of untreated and treated sample were shown in Figure 2 and 3, respectively. There were some distinct differences. The intensity of m/z 136 at 5 min (about 400°C) was decreased after treatment. This peak was probably from additives. In addition, the intensity of m/z 373 was increased after treatment. This peak was probably from rubber degradants.

Target

Material analysis / Quality control / Synthesized chemistry

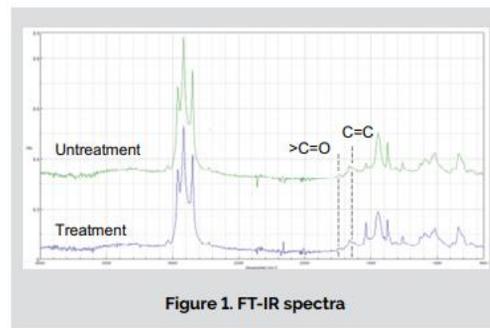


Figure 1. FT-IR spectra

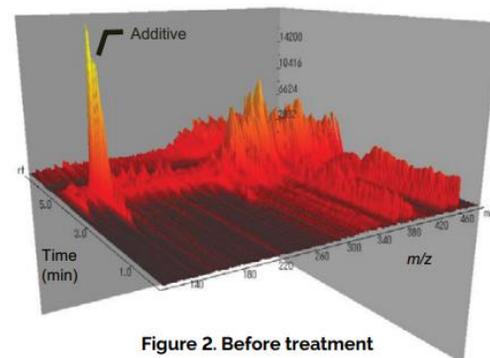


Figure 2. Before treatment

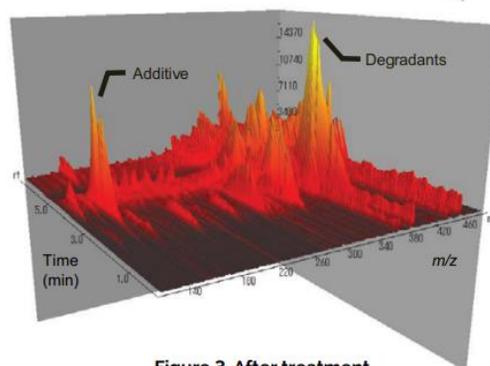


Figure 3. After treatment

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