

Evaluation of thermal history of plastics using additive markers

【Keyword】 recycle plastics thermal history antioxidant ionRocket DART®-MS

■ Abstract

Thermoplastic resins are regarded as important materials for realizing a sustainable society. However, thermoplastic resins are weakened by thermal history addition in physical properties such as strength and elongation. Therefore, it is important to control and grasp the thermal history of polymer recycle. So, the purpose of this application was to evaluate the thermal history, directly and rapidly.

■ Samples

Polypropylene pellet; 1) Virgin pellet, 2) 3× recycled pellet

■ Methods

Samples were cut into about 1mm square, and then placed into the ionRocket copper sample pot. A temperature gradient of 100 °C/min from room temperature to 600 °C was applied (total run time:7 min.)

■ Results

TIC and MS spectra of measured at 260°C were shown in Figure 1.and Figure 2.

Regarding the TIC, no significant difference was detected between the samples, and similar thermal decomposition patterns were observed. However, regarding the MS spectra, Irgafos 168 and its oxidized compound were detected. In comparing the intensity ratios of the oxidized Irgafos 168 and pure Irgafos 168 between the samples, the ratio of the 3× recycled pellet was higher than that of the virgin pellet. This confirmed that the 3× recycled pellet increased oxidized Irgafos168 by recycle. In addition, in comparing the extracted ion current grams for Irgafos168 between the samples(Figure 3), the 3× recycled pellet showed less than the virgin pellet. This confirmed that Irgafos168 was consumed by recycle. In summary, by using this method, additives contained in a polypropylene pellet and the polypropylene polymer matrix were detected independently and directly by gradient thermal heating. This method can be a useful way to evaluate the thermal history of recycled thermoplastic resins quickly and easily, by using the antioxidants contained in the thermoplastic resins as markers. Moreover, this method could be applied to quality control for thermoplastic resin products, such as containers and parts.

