

[Temperature-dependent pyrolysis behavior of polyurethane elastomers with different hard- and soft-segment compositions](#)

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Abstract:

The pyrolysis behaviors of seven kinds of polyurethane elastomers (PUEs) with different ratios between the hard segment (HS) and soft segment (SS) were investigated for both fast pyrolysis (300, 350, 450, 850 °C) and slow pyrolysis at the heating rate of 10 °C min⁻¹ by thermogravimetric analysis (TG), pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS), and evolved gas analysis-mass spectrometry (EGA-MS). These PUEs were synthesized from 4,4'-diphenylmethane diisocyanate (MDI), 1,4-butane diol (BD), and poly(oxytetramethylene glycol) (PTMG). Atomic force microscopy measurements found that the HS domains were formed in PUEs containing HS, and these domains were aggregated at extremely high HS ratio. The main pyrolysate derived from HS was MDI under all conditions. In fast pyrolysis tests, the decomposition of SS proceeded sufficiently at 450 °C, and a lot of low molecular weight compounds were produced at 850 °C. In slow pyrolysis tests, three-step degradation was observed, and this degradation behavior was influenced by the HS domain and SS matrix structures. The first step is the HS pyrolysis inside the HS domain, then the HS surrounded by SS is pyrolyzed. Finally, the SS matrix is pyrolyzed. The HS pyrolysates changed from isocyanate to amine with increasing temperature. We believe that the newly found pyrolysis behavior of PUEs with different ratios between the HS and SS will promote future studies on the characterization of PUE materials and the pyrolytic recovery of chemical feedstock from PUE wastes.

* Excerpted from online journal website (Click the title)

Frontier Labs Products used:

Multi-Shot Pyrolyzer (EGA/PY-303D), Ultra ALLOY⁺-5, UADTM