

Analysis of Recycled Polypropylene

~Cause analysis of decrease in the physical properties ~

Considering the recycling of automobile materials, it is essential to reuse polypropylene (PP). However, it is often occurred that unexpected physical properties are obtained. We investigated the factors for deterioration of physical properties of recycled PP with different grade.

Sample and physical properties

Sample	Detail	MFR	Charpy impact value	Heat distortion temperature
Virgin PP	Block PP for automobile	30	8.9 KJ/m ²	98 °C
Recycled PP (High grade)	Pre-consumer. Talc and CB are included	30	7.2 KJ/m ²	94 °C
Recycled PP (Low grade)	Post-consumer. Talc and CB are included	30	6.1 KJ/m ²	102 °C

※MFR / Melt mass-flow rate

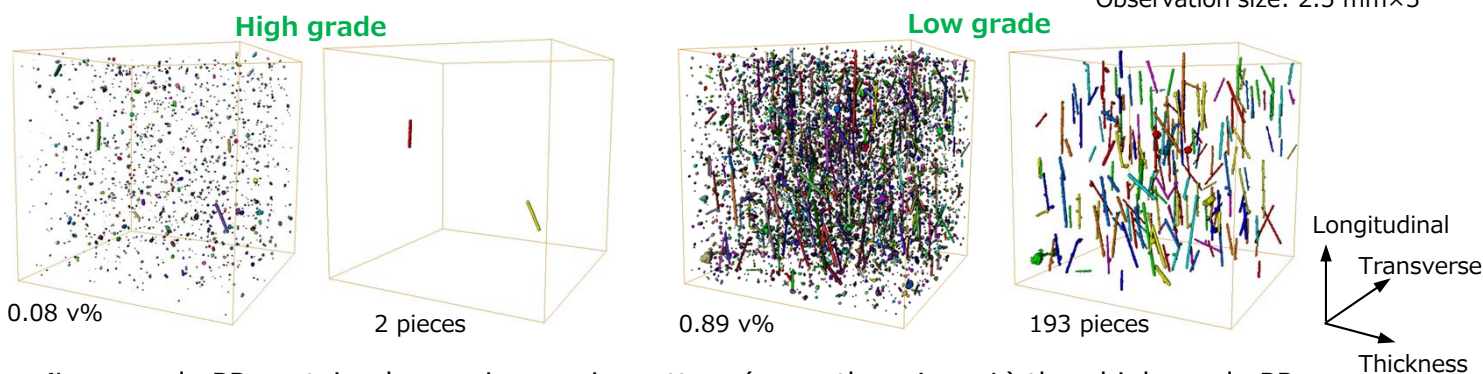
Charpy impact value : Correlate with the grade
Heat distortion temperature : No correlate with the grade

⇒ **Cause analysis**

X-ray CT

3D observation of inorganic matters with a size of more than 4 μmΦ.
 Extraction of fibrous inorganic matters with a length of more than 200 μm.

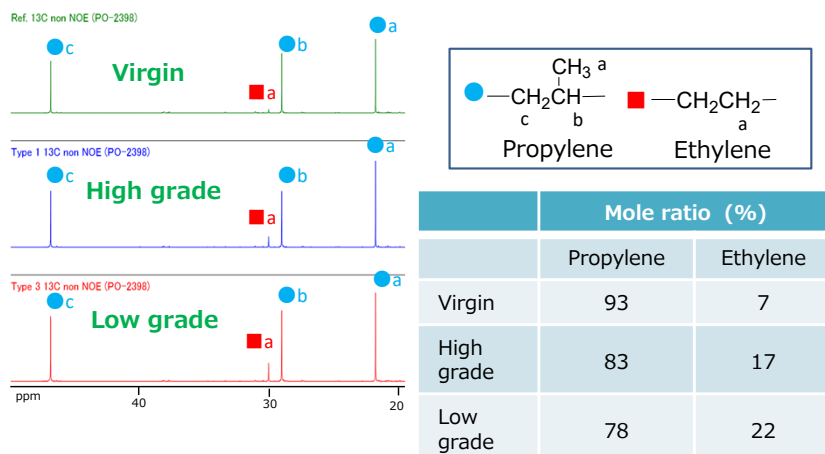
Observation size: 2.5 mm×3



- ✓ Low grade PP contained more inorganic matters (more than 4 μmΦ) than high grade PP.
- ✓ Fibrous inorganic matters are longitudinally oriented in low grade PP.

¹³C NMR

Calculation of mole ratio between propylene and ethylene unit.



- ✓ More ethylene unit in virgin than recycled PP.
- ✓ More ethylene unit in low grade than high grade.

Consideration

Charpy impact value

Inorganic matters observed by X-ray CT and ethylene unit affected the strength reduction.

Heat distortion temperature :

Low heat distortion temperature in the high-grade recycled PP was due to the presence of polyethylene (PE), which has lower melting point.
 Low grade recycled PP included a lot of fibrous inorganic matters. The orientation of fibrous inorganic matter raised the heat distortion temperature.