Studies on the Injection Molding of Polyimides AURUM and ISAS-TPI

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Introduction

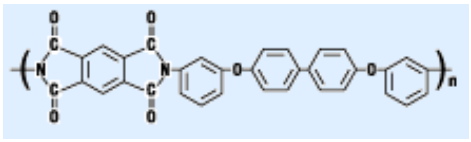
In order to investigate injection molding behaviors of the thermoplastic polyimide such as AURUM and ISAS-TPI, some test specimens of these polyimides were made by injection molding and the thermal properties and mechanical properties were measured.

Results and Discussion

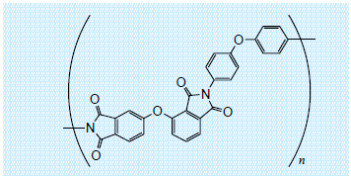
The structures of the polyimides AURUM and ISAS-TPI were showed in Scheme1. These polyimides are poor in liquidity even if at high temperature because of their rigidity of molecular chains. So we tried many injection conditions and found that under an optimum condition, the perfect molded product could be obtained. Fig.1 showed the polyimide pellets and mold dumbbell-shaped test specimens with length of 215mm, width of 12.7mm, and thickness of 3.0mm. These test specimens were used to measure the thermal properties by TG/DTA and mechanical properties by pulling and bending test. The test results showed in Table1～3 for polyimide AURUM and Table4,5 for ISAS-TPI. It showed that the temperature of 5% and 10% weight loss for filler reinforced AURUM is higher than unreinforced one both in nitrogen and in air [Table1 and Table2]. On the other hand, the tensile stress, bending stress and bending modulus are greatly increased for filler reinforced AURUM than that of unreinforced one [Table 3]. It means that strengthening effect was observed without impairing injection molding

Conclusions

For the injection molding of polyimides AURUM and ISAS-TPI, various injection conditions were investigated and the injection of these polyimides has become possible. This would be expanding the use of these polyimides.



AURUM



ISAS-TPI

Scheme 1. Structures of polyimides AURUM and ISAS-TPI

Pellets

Dumbbell-shaped test specimens

Fig1. Pellets and injection molded dumbbell-shaped test specimens

Table1. Thermal properties of AURUM（in nitrogen）

Grade name	PL450C	JCN3030	JGN3030
Filler type	Unreinforced	Carbon fiber 30%	Glass fiber 30%
Melting point (℃)	**388**	**388**	**388**
Glass transition point (℃)	**250**	**250**	**250**
Thermolysis start temperature (℃)	**553**	**553**	**553**
5% weight loss temperature (℃)	**570**	**575**	**572**
10% weight loss temperature (℃)	**577**	**585**	**580**

Table2. Thermal properties of AURUM（in air）

Grade name	PL450C	JCN3030	JGN3030
Filler type	Unreinforced	Carbon fiber 30%	Glass fiber 30%
Melting point（℃）	**388**	**388**	**388**
Glass transition point（℃）	**uncleared**	**uncleared**	**uncleared**
Thermolysis start temperature（℃）	**554**	**550**	**549**
5% weight loss temperature（℃）	**560**	**557**	**565**
10% weight loss temperature（℃）	**580**	**585**	**580**

Measured by TG/DTA 7300 from 30℃ to 800℃ at rate of 20cel/min in nitrogen or air

Table3. Mechanical properties of AURUM

Grade name	PL450C	JCN3030	JGN3030
Filler tape	unreinforced	Carbon fiber 30%	Glass fiber 30%
Tensile strength (MPa)	**89**	**225**	**141**
Tensile elongation (%)	**90**	**2**	**2**
Bending strength (MPa)	**81**	**345**	**205**
Bending modulus (GPa)	**2**	**22**	**9**

Tested by Instron 5567 at 2mm/min of pull speed

Table4. Thermal properties of ISAS-TPI

	In nitrogen	In air
Melting point（℃）	**366**	**uncleared**
Glass transition point（℃）	**250**	**250**
Thermolysis start temperature（℃）	**528**	**548**
5% weight loss temperature（℃）	**555**	**563**
10% weight loss temperature（℃）	**573**	**578**

Measured by TG/DTA 7300 from 30℃ to 800℃ at rate of 20cel/min in nitrogen or air

Table5. Mechanical properties of ISAS-TPI

	ISAS
Tensile strength（MPa）	**89**
Tensile elongation（%）	**2**

Tested by Instron 5567 at 2mm/min of pull speed