Polycarbonate modified by Thermosetting resin

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Introduction:

Polycarbonate (PC) is one of the most widely used plastic in the world due to its favourable mechanical property and heat resisting,however,It is difficult to processe—usually the molding temperature is also very high due to its high melt viscosity.

In this study small amounts of crosslinkable monomer, diallyl orthophthalate (DAOP) were used as a free-radical crosslinkable reactive plasticizer to low down the temperature during processing.There are several reasons for this:

(1) DAOP has a high boiling temperature (290),so，it can be used under the processing temperature of PC.

(2) DAOP can be polymerized ,but it does not form net structure durning the processing of PC therefore it would not influence the processability of mixture.

(3) A structural similarity to PC which should result in the high compatibility.What's more, after curing,DAOP can compensate thermal and mechanical properties of PC which was lossed in the blending process.

Considering the processing temperature(reach to 200 or even higher),

2,3-dimethyl-2,3-diphenylbutane (DMDPB) was chosen as initiator of DAOP because of high pyrolysis temperature which can be used over 200 .

In this paper curing process of 2,3-dimethyl-2,3-diphenylbutane(DMDPB)/diallyl orthophthalate(DAOP) curing system and processing performance of PC/ DAOP / DMDPB system were discussed.

Experimental:

1) study of DMDPB/ DAOP curing system

(1) Sample preparation

Samples for curing studies were prepared by dissolving various amounts of the initiators into the monomers by solvent blending method. In this method, DAOP was mixed with 1、1.5、2、2.5 wt% of DMDPB solution in dichloromethane at room temperature.After dissolving completely, The mixtures were dried at 80 for 12h to evaporated most of solvent for using.According to different of DMDPB, the those sample were named number1,2,3and4 as Table 1,respectively.

Table 1 number of sample

Numberr	1	2	3	4
Sample	DMDPB/ DAOP=1/99	DMDPB/DA OP=1.5/98.5	DMDPB/ DAOP=2/98	DMDPB/DA OP=2.5/97.5

(2) Sample treatment

Table 2 displayed curing the samples in the oven under the certain temperature and time. Gel contents in the cured DAOP/DMDPB samples were determined by solvent extraction and gravimetry. Samples with various DMDPB contentswere cut into small pieces, and subjected to Soxhlet extraction for 3-4 h refluxing with dichloromethane. The insoluble gel was dried in a vacuumoven to remove the residual solvent and then was weighed.

Table 2 Curing the sample

Curing environment		Samples	Curing environment		Samples
Time（min）	Temperature（℃）		Time（min）	Temperature（℃）	
60	180 190 200	No1、No2 No3、No4	150	180 190 200	No1、No2、 No3、No4
90	180 190 200	No1、No2 No3、No4	200	180 190 200	No1、No2、 No3、No4
120	180 190 200	No1、No2 No3、No4			

2) Study of processability of uncured PC/ DAOP/ DMDPB system

It is glass transition temperation who is one of most imporment paraments to measure mixtures processability. Various amounts of DAOP were mixed with PC in internal mixer by melt blending method, DMDPB was also added .A Rheometric Scientific Mark IV model dynamic m echanical thermal analyser (DMTA) was used in duel cantilever bending mode to measure the glass transition temperature of uncured mixtures, over the temperature range from100 to 150 at 2 per min at 1 Hz with bar-type specimens of dimension 20 mm×5 mm×1.5 mm. The Tg was defined as the temperature corresponding to the maximum in tanD.

Conclusion:

1)Study of DMDPB/ DAOP curing system

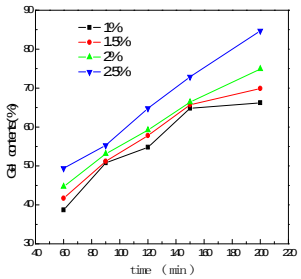

Fig 1 Gel contents of the cured DAOP/DMDPB blend and in various pressentage of the DMDPB in blend as a function of the heating time

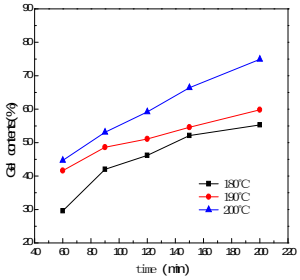

Fig.2 Gel contents of the cured DAOP/DMDPB blend and in various heating temperature as a function of the heating time

Gel contents given in Fig.1 appears to rapidly rise with increasing initiator content. Considering the explosive polymerization,the content of initiator should be control.So in this experiment we select 2% DMDPB as the optimum initiator content. As curing temperature increases from 180℃ to 200℃ given in Fig.2,gel contents rise gradually. Once the temperature rises to more than 200 explosive polymerization were found. Fig.2 also shows that the rising rate of gel contents is reduce when heating more than 200min. Thus we draw the conclusion that gel contents were the most high when DAOP/DMDPB(98/2) were heating 200min under 200 .

2) Study of PC/DAOP/DMDPB system

During preparation of the samples by the melt blending method, it was found that DAOP very effectively decreases the processing temperature: for example,a transparent and homogeneous sample with 70 wt% PC and 3 wt% DAOP was obtained at 50℃. Fig. 3 shows the DMTA curves of uncured PC/DAOP samples prepared by melt blending, from which it Tg of blend appears to decrease with increasing DAOP content.effectively.

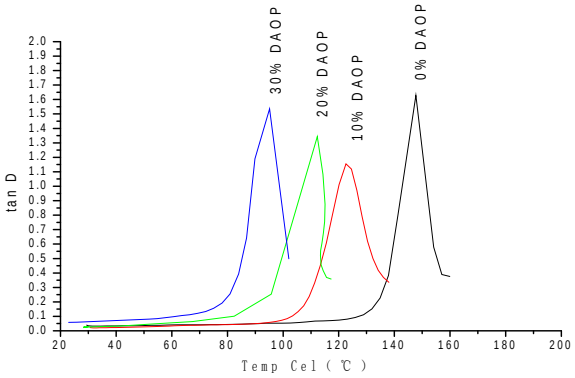

Fig. 3. The tan D curves showing T_g of PC/DAOP/DMDPB blends

References:

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