

THERMAL BEHAVIOR OF FLUORINATED POLY(ARYL ETHER DKETONE)S

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Introduction

Poly(aryl ether ketone)s (PAEK) are of great scientific and technological interest because of their range of outstanding properties such as thermal stability and excellent mechanical properties. The incorporation of fluorine atoms into the chain leads to polymers with increased solubility, flame resistance and etc.^{1,2} We report here the study of the thermal behavior on amorphous fluorinated poly(aryl ether ketone)s using dynamic mechanical analysis (DMA) and differential scanning calorimetry (DSC), to gain an insight into the effect of chemical structure on thermal behavior and to make a comparison of DSC and DMA studies.

Experimental

Dynamic mechanical analysis. The dynamic mechanical response of the polymers was examined using a Netzch DMA-242 (Germany). Samples were heated between 50°C to 200°C at 3°Cmin⁻¹ with an applied frequency of 3.33Hz. The main parameter of interest was tanδ. The glass transition temperature was defined as the temperature corresponding to the peak maximum.

Differential Scanning Calorimetry. Differential scanning calorimetry (DSC) was performed between 50°C and 300°C at a rate of 20°C/min using a Mettler Toledo DSC821^e Differential Scanning Calorimeter calibrated with indium and zinc.

Results and Discussion

The dynamic mechanical behaviors of fluorinated poly(aryl ether ketone)s were investigated and Figure 2. show the variation of both storage and loss moduli with temperature for 6F-PEEDK, measurements were made at a frequency of 3.33Hz. From measurements of the storage and loss moduli, the tanδ was calculated. This parameter corresponded to the ratio of loss to storage modulus. It can be seen in Figure 3. All the fluorinated poly(aryl ether ketone)s studied show an α Relaxation peak, which corresponded to the glass transition temperature, and these peaks are in good agreement with the measurement by DSC. (Figure 4) Increasing the bulk and stiffness of the connecting unit shifts the Tg to higher temperature,³ and this is particularly significant in the case of biphenyl connector group in 6F-PEEKDK where the Tg reaches 180°C. The polymers peak values of α relaxation were a little lower than the glass transition temperatures measured by DSC, and the comparisons were listed in Table 1.

Table 1. The parameters of fluorinated PAEKs

	6F-PEEK	6F-PEEKK	6F-PEEKDK
Location of α Relaxation (°C)	131	162	178
DSC (Tg) (°C)	151	164	182

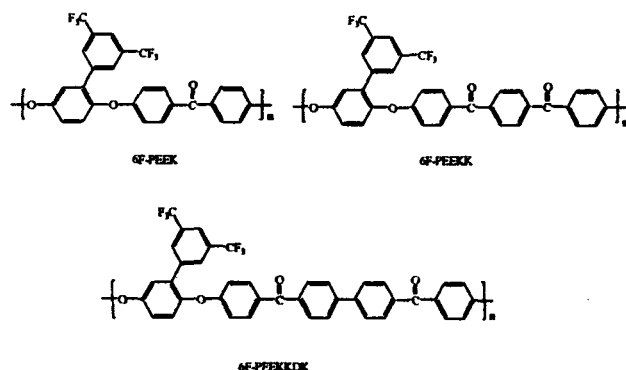


Figure 1. Chemical Structures of Poly(aryl ether ketone)s

Conclusions

The glass transition temperatures (T_g) of the poly(aryl ether ketone)s studied here, as measured by DSC and DMA, show significant variation which can be accounted for from consideration of polymer structure. 6F-PEEKDK was found to have the highest T_g .

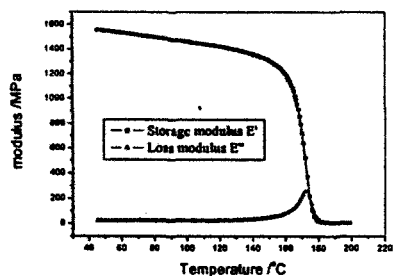


Figure 2. The α Relaxation for 6F-PEEKDK as measured by DMA at 3.33 Hz

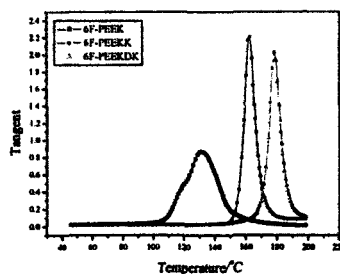


Figure 3. The variation of the α transition temperature with PAEKs as measured by DMA

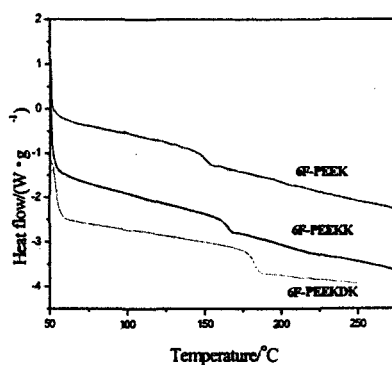


Figure 4. DSC curves of PAEKs

References

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