Atomic Oxygen Resistant Poly (imide siloxane) Copolymers / Polyimide Composite Films

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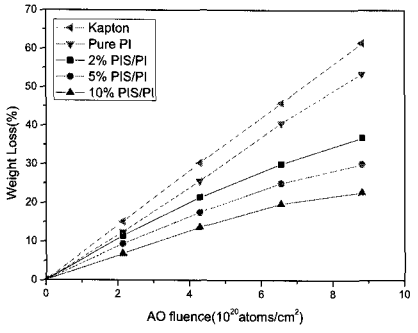
Aromatic polyimide (PI), which possesses excellent thermal stability and mechanical properties, has been considered as an important candidate for solar cell blanket and thermal blanket used in aerospace technology. There are many studies focused on this field. Therein, modification of polyimide has be attracted much attention in order to satisfy the environment at low earth orbit, especially resist atom oxygen (AO).

In the previous work, we have succeeded in preparing a novel composite polyimide film by surface modification with siloxane [1], so that the film contains different content on each surface. In this report, we prepared a series of the composite films based on poly (imide siloxane) (PIS) copolymer and PI (s-BPDA/4, 4'-ODA) with different ratios. It is found that the films exhibit good mechanical properties and thermal stability [Table 1]. Atomic oxygen (AO) exposure experiments were conducted in a ground-based AO effects simulation facility on the composite film samples with Kapton film sample as the frame of reference [2]. The variation curves of mass loss percentage and Erosion yield along with AO exposure fluence are shown in Figure 1 and Figure 2, respectively. It was found that the mass loss rate and erosion yield decreased as the increase of PIS content. It is meant that siloxane improved the AO resistant performance of the polyimide composite film.

Table 1. The Data of the Composite Films

sample	Strength (MP)	Modulus (GP)	Elong (%)	Tg (℃)	Td_5 (℃)		Char yield* (%)
					Air	N_2	
Pure PI	180	3.30	36	281	579		63
2%PIS-PI	174	2.97	126	273	527	562	64
5%PIS-PI	149	2.92	87	273	521	550	64
10%PIS-PI	143	2.64	112	272	491	528	63

* Char yield at 800℃ in N_2 by TGA, heating rate 5℃/min



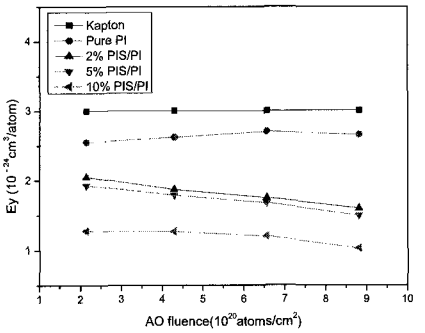


Fig.1. Mass loss percentage of the composite films Fig.2. Erosion yield of the composite films

References

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[2] Shen Zhigang, Zhao Xiaohu, Chen Jun, et al., Acta Aeronautica et Astronautica Sinica, 21(5):425-430(2000)