



Preparation and properties of polyimide/silica hybrid films

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ABSTRACT

Hybrid films of polyimide/silica were prepared via sol-gel process. The films were characterized by FTIR, TGA, DSC, SEM, and UV-Vis. The results showed that the hybrid films had good thermal stability and mechanical properties. The glass transition temperature (T_g) of the hybrid films increased with the silica content. The films were transparent and had good adhesion.

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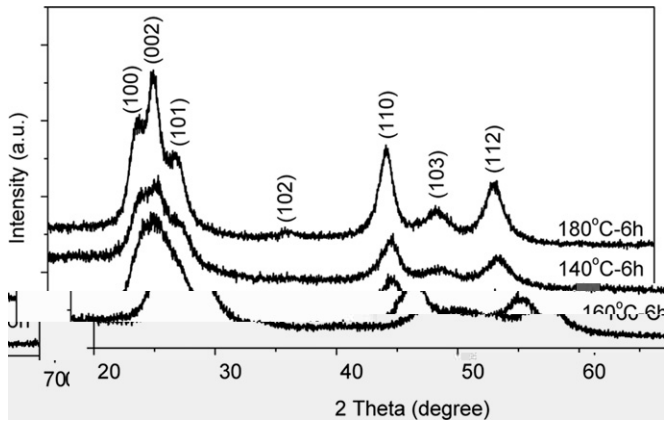


Fig. 1. RD ↓ S-140, S-160 S-180 ↓ ↓.

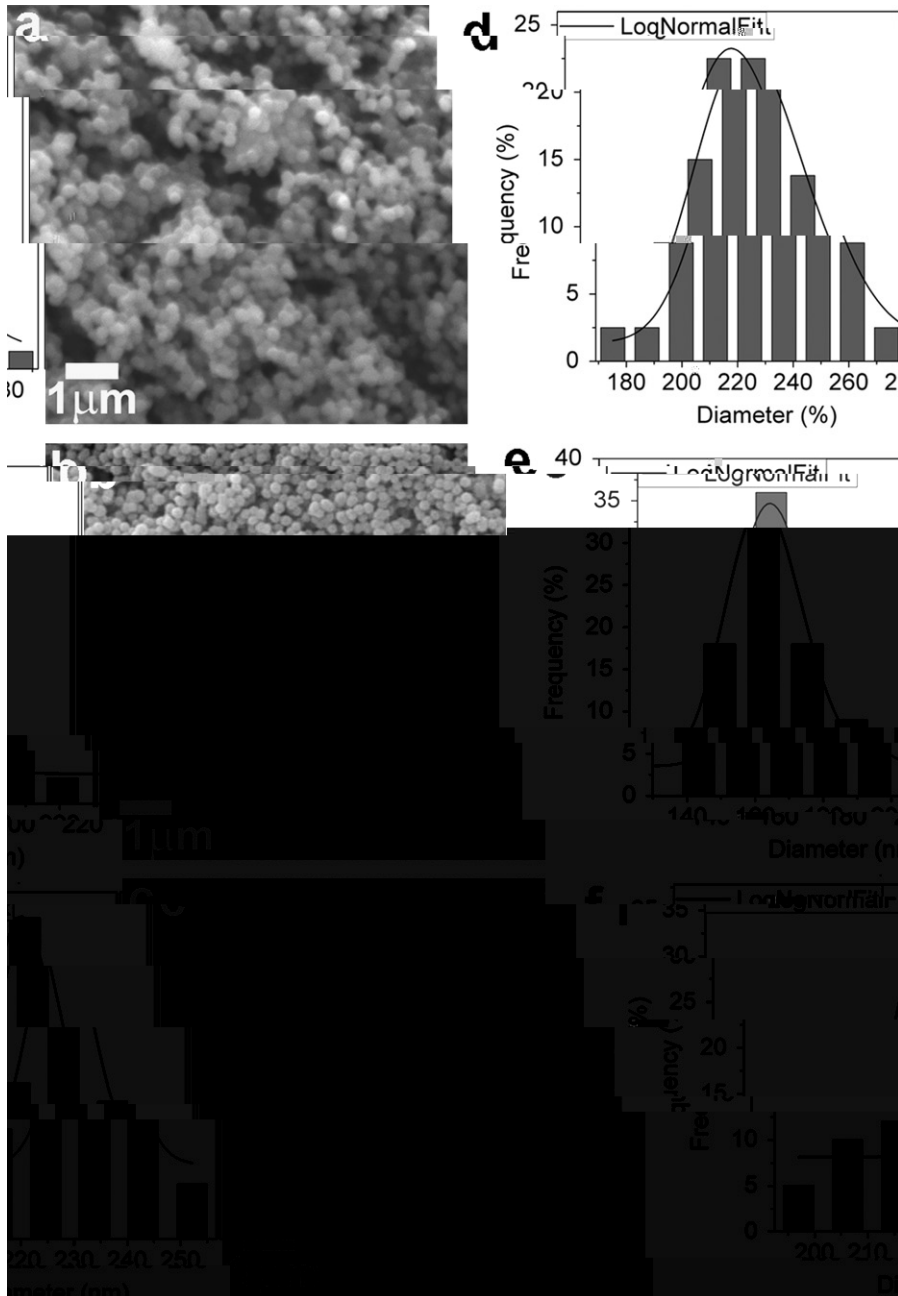
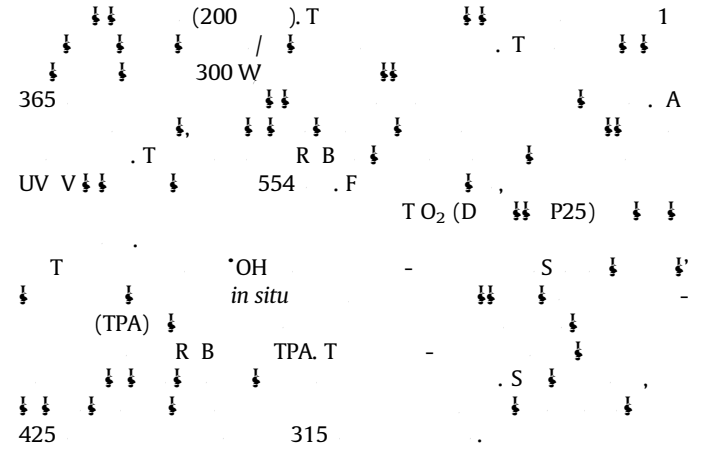


Fig. 2. () SEM ↓ S-140, S-160 S-180 ↓ ↓. () P ↓ ↓ S-140, S-160 S-180 ↓ ↓.

3. Results and discussion

RD (F. 1),
 27.18, 28.64, 30.50, 39.62, 47.75, 52.02
 (100), (002), (101), (102), (110), (103)
 (JCPDF 36-1450),
 SEM (F. 2),
 S-140, S-160, S-180
 230.3, 169.7, 233.5
 BET, SSA
 131.2, 222.4
 S-140, S-160, S-180
 108.0, 12, 24
 160 °C
 (F. 3),
 12, 24
 203.1 (12), 268.5 (24)
 (F. 3)

UV (F. 4),
 S-140, 326, S-160, 340
 S-180, T
 S-160, T
 UV (F. 4),
 120, S-160, 96.6%,
 140 (28.8%), S-180 (44.1%)
 P25 (75.7%), T
 S-160, S-180
 SSA
 R B (F. 4), F
 (ICP MS)
 2+
 (*OH)
 14, T

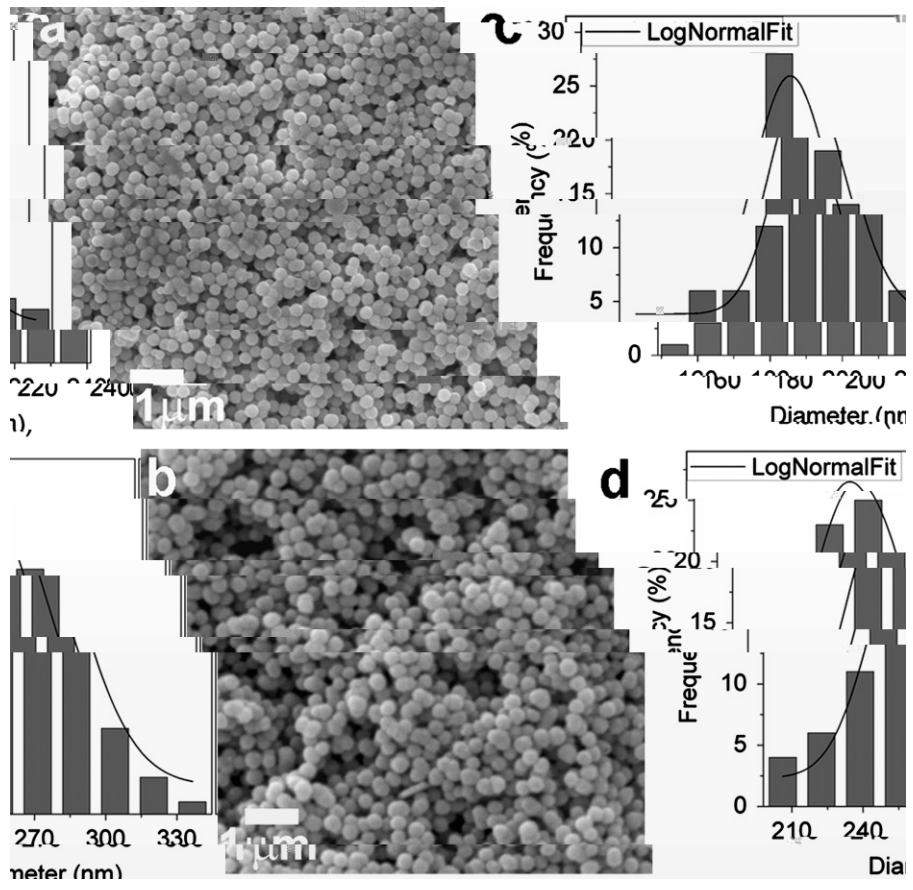
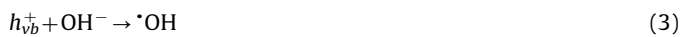


Fig. 3. (a) SEM image and LogNormalFit histogram of S-12. (b) SEM image and LogNormalFit histogram of S-24. (d) SEM image and LogNormalFit histogram of S-160. All samples were prepared at 160 °C.

$(F . 4)$, *in situ* (PL) $\cdot\text{OH}$. M, PL $\cdot\text{OH}$ S-140
 160 S-180 S-140
 S-180 B R B S
 F, S
 (vb) T (cb), (h_{vb}^+)
 (E . (1)). S, h_{vb}^+ e_{cb}^- (e_{cb}^-)
 $\cdot\text{OH}$ (E . (4)). R B $\cdot\text{OH}$ (E . (2)) (3). F
 $S^+ \rightarrow S(e_{cb}^- + h_{vb}^+)$ (1)



4. Conclusions

I, - S, S
 T - $\cdot\text{OH}$, S
 UV,

Acknowledgments

T, N, N
 S, F, C (21171051, 21271066, U1204516)
 P, C, S, I, R
 T, U, (IRT1061), I, F, O
 S, H, P, (114200510004), K
 T, P, H, P (2012GGJS-065)
 H, N, U

References

- 1 M, N, B, P, N, P, B, MK, E, E, S
2005;61:105-113.
- 2 V, AK, D, RR, B, P, J, E, M, 2012;93:154-168.

7 C D, H F, R G, L D, M, W N 12 H, W Q, C C 2010;46:8941 3.
 2010;2:2062 4. 13 H, H GC, JQ, J A C S
 8 G L, W L, S , F Q, L, . M L 2012;74:26 9. 2004;126:6874 5.
 9 G W J, T , D F, W K, M , . C E C 14 K-, F A, W T, H K. E C
 2012;14:1185 8. 2000;2:207 10.
 10 L H J, T, C R, L J. J M C . 2011;21:16621 7. 15 W, S FN. J A C S 2008;130:12566 7.
 11 M M, A R, S M. ACS A M I 2010;2:1817 23.