# Preparation,Characterization and Properties of novel Polyhedral Oligomeric Silsesquioxane-polybenzimidazole Nanocomposites by Friedel-Crafts Reaction

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**ABSTRACT**: the organic-inorganic nanocomposites involving OPBI (Poly [2, 2'-(p-oxydiphenylene)-5, 5'-bibenzimidazole]) and polyhedral oligomeric silsesquioxane (POSS) were prepared via in situ polymerization of 4, 4'-Dicarboxydiphenyl ether (DCDPE) and 3, 3'-Diaminobenzidine (DABz) in the presence of the POSS where the organic group on silsesquioxane cage is phenyl. The DMA results showed that the moduli of the POSS-g-OPBI/OPBI nanocomposites were significantly higher than OPBI matrix, indicating the nano-reinforcement effect of POSS cages. Thermo gravimetric analysis indicated that the thermal stability of the polymer matrix was not sacrificed but improved by introducing a small amount of POSS since POSS showed lower thermal stability than OPBI. More importantly, the mechanical properties, including tensile and yield strength, Young's modulus, toughness, were obviously simultaneously increased by introducing POSS into the nanocomposite, which is quite differently from the traditional nanocomposites, where the ductility and toughness of polymer were usually reduced substantially upon the incorporation of inorganic reinforced agent.

**KEWORDS**: Polybenzimidazole, Polyhedral oligomeric silsesquioxane, nanocomposites

## 1. Results and discussion

The stress-strain curves of POSS reinforced OPBI composite prepared via F_C reaction are shown in Figure 2.a. Composites of OPBI-POSS via physical blending were also studied for comparison, and their stress-strain curves and mechanical properties are shown in Figure 2.b. we can see that composites prepared by F_C reaction, showed much better reinforcing effect with the incorporation of POSS. Upon the addition of only 2 wt % POSS-g-OPBI, the Young's modulus, tensile strength, toughness are all improved by 31 %, 76 %, 138.2 %, respectively. More importantly, the ductility for the composites is not reduced but improved, which overcomes the brittleness brought by the addition of inorganic reinforced agent, a traditional shortcoming.

## 2. Conclusion

A facile method to prepare the POSS reinforced OPBI nanocompostites is established by initiating the polymerization of DCDPE and DABz in the presence of octaphenyl POSS. POSS units were incorporated in the OPBI matrix via F_C reaction, which resulted in the good dispersion of POSS in OPBI matrix as evidenced by SEM. In the meantime, POSS can display a highly effective reinforcement toward to the OPBI matrix. Retention or even improvement in ductility and toughness can be achieved by the use of polymer grafted inorganic agents.

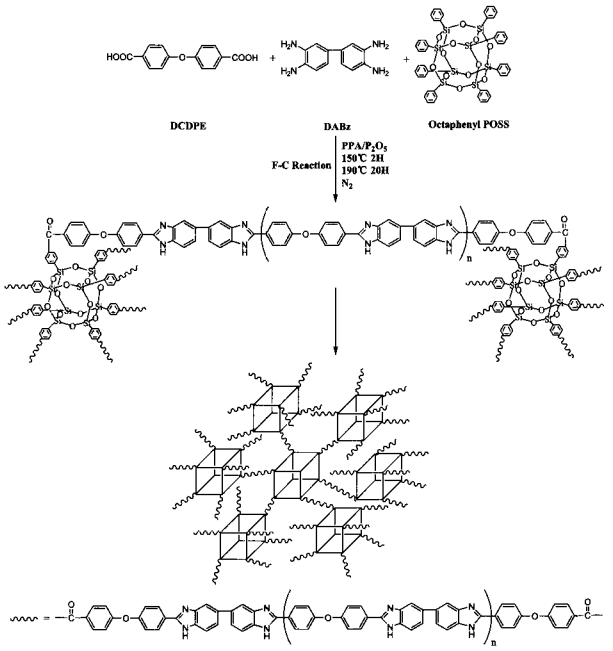


**Figure 1.** Octaphenyl POSS/OPBI nanocomposite

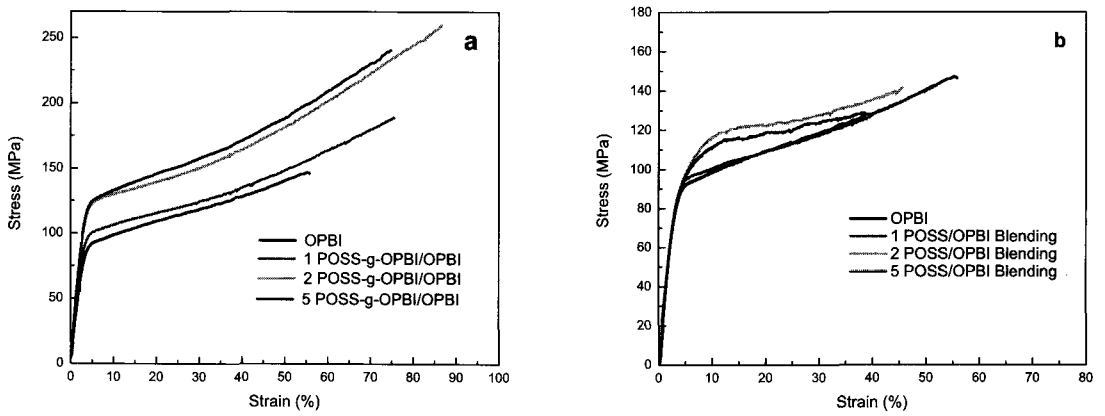


**Figure 2.** Selected, representative stress-strain curves: (a) POSS-g-OPBI/OPBI nanocomposites, (b) POSS/OPBI blending hybrids.