Fabrication and Structural Analysis of Aromatic Polyimide Ultrathin Films with Different Fluorine Contents

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An organic thin film can be deposited on a solid substrate by various techniques such as thermal evaporation, sputtering, electro-deposition, Langmuir-Blodgett (LB) technique, etc. It is well known that polyimide (PI) is a high performance polymer possessing excellent thermal stability, and good electrical properties, etc. PI can not form a stable monolayer or be deposited to LB films by traditional LB techniques because of its lack of hydrophilic and hydrophobic groups at its ends. Kakimoto, et al. [1] and Uekita. et al. [2] have developed a so-called 'precursor' method for the preparation of PI LB films in which polyamic acid salts (PAAS), the precursors to PI, are amphiphilic and able to form a stable monolayer, which can be further deposited to LB films and then cured to form PI LB films. PI LB films with special characteristics have been widely used in many high-tech fields.

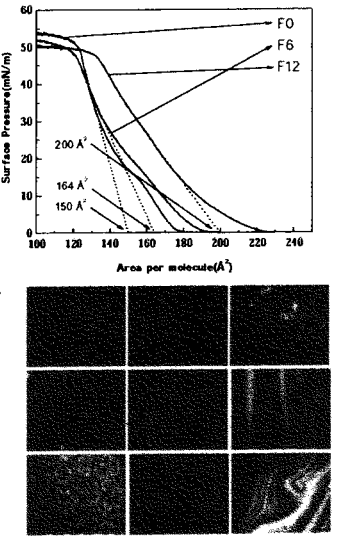

Figure 1. π-A isotherms and BAM images of three type of PAAS monolayers

The monolayer behavior and structural difference of PI LB films with different fluorine contents are studied. Three types of polyamic aicd (PAA) were produced from polymerization of 3,3,4,4'-biphenyltetracarboxylic dianhydride (BPDA) / 4,4'-oxydianiline (ODA), BPDA /2,2'- bis(trifluromethyl) benzidine (TFDB) and 4,4'-(hexafluoro isopropylidene)-diphthalic anhydride (6FDA) / TFDB in N,N-dimethylacetamide (DMAc). The three types of PAAS using *O,O',O''*-trihexadecanoyl-triethanolamine formed stable monolayers and transferred to solid substrates to prepare the LB film. The PAAS LB films were converted to PI LB films using thermal treatment. The behaviors of PAAS monolayers at the air/water interface depend on the fluorine contents. On increasing the amount of fluorine atoms in the main chain, the area per molecules of each monolayer was increased. The three monolayers showed different collapse behaviors.

References

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