Measurement of Molecular Layer Deposited (MLD) Polymer Thin Films using Transient Thermoreflectance Method

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Molecular layer deposition (MLD) technique, similar to atomic layer deposition which has been used to grow gate dielectrics and hermetic barrier layers, typically utilizes sequential and self-limiting reactions with bifunctional monomers to grow conformal polymer thin films. A variety of polymer thin films including organic conductors can be grown using MLD. These films are expected to have aligned polymer chains and thus anisotropic properties due to the nature of the MLD growth technique. In this work, the two-color optical pump-and-probe method (transient thermoreflectance method) using sub-pico second laser is used to measure the thermal properties of MLD polymer thin films. The results demonstrate the polymer chain length dependence and temperature dependence of thermal conductivity of the MLD polymer thin films. Moreover, the thermal conductivity of MLD polymer thin films with different chemical designs is compared. This study could guide the design of high thermal conductivity polymer thin films with aligned-chains.