physica status solidi (a)

Volume 184, Issue 1 , Pages 41 - 50

Published Online: 20 Mar 2001

Original Paper

Raman Studies of Molecular Thin Films

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Keywords

63.20.-e • 68.55.Ac • 78.30.Jw • S5 • S12

Abstract

In situ Raman spectroscopy was applied to study thin films of molecules, i.e. C_{60} and 3,4,9,10-perylene tetracarboxylic dianhydride (PTCDA) fabricated by Organic Molecular Beam Deposition (OMBD) under ultra-high vacuum conditions. C_{60} was evaporated onto Si(100) surfaces at room temperature and the deposition process was monitored in situ by Raman spectroscopy in the spectral region 1350-1600 cm^{-1}, where the most intense Raman features of C_{60} are observed. Changes observed in the initial stage of deposition indicate that laser induced photopolymerisation of C_{60} is inhibited until approximately 15 nm film thickness. PTCDA films were also grown by OMBD on Si(100) substrates at different growth temperatures in the range between 230 and 470 K. The Raman spectra exhibit four features assigned to external vibrational modes, that occur as a consequence of the arrangement of the PTCDA molecules in a crystalline environment. The full width at half maximum of these phonon lines decreases with increasing substrate temperature. A similar tendency is also observed for the Raman-active internal molecular modes. The observed spectral changes are related to an increase in the size of the crystalline domains within the films.

Received: 19 June 2000; Accepted: 2 January 2001

Digital Object Identifier (DOI)

10.1002/1521-396X(200103)184:1<41::AID-PSSA41>3.0.CO;2-S About DOI