

氩氢体积比对磁控溅射制备Al_xO_y/PET阻隔膜的影响 Characterization of Al_xO_y Barrier Films on PET Substrate Prepared by Magnetron Sputtering

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摘要: 采用直流电源,以纯铝为靶,氧气为反应气体,高纯氩气为溅射气体磁控溅射在PET基底上制备高阻隔性Al_xO_y/PET包装薄膜,并研究不同氩氢体积比对Al_xO_y薄膜形貌、成分、结构的影响,讨论了镀Al_xO_y膜后PET力学性能与阻隔性能的变化。FTIR与XPS研究分析表明,反应氧气量直接影响Al_xO_y薄膜的化学结构,薄膜的红外光谱的峰值、强度和带宽等变化规律均与氧气量有关,并且Al_xO_y中氧原子的含量越高,Al—O伸缩振动峰的波数越高。测量薄膜的阻隔性与力学性能显示,Al_xO_y膜化学成分越接近于Al₂O₃时阻隔性能越好,且薄膜横向、纵向弹性模量及屈服强度越大。此外,镀Al_xO_y薄膜单向拉伸力学特征有明显变化,其应力-应变曲线有2个明显的拐点。Aluminum oxide (Al_xO_y) films were deposited on the polyethylene terephthalate (PET) foils as barrier coatings using conventional DC magnetron sputtering, in which argon, oxygen and pure aluminum were used as a sputtering gas, reaction gas and target, respectively. The influences of oxygen and argon flux ratios on the surface morphology, stoichiometry and structure of Al_xO_y films were investigated. The mechanic and barrier properties of Al_xO_y /PET were discussed, too. Fourier transform infrared spectrum (FTIR) and X-ray photoelectron spectroscopy (XPS) investigations indicated that a strong relation between oxygen addition and compositions of Al_xO_y films, the aluminum oxide IR spectrum's peak value, the intensity and the band width. Also, the Al—O expansion vibration peak's wave number was proportional to the oxygen atom content in Al_xO_y. The studies about films barrier and mechanical characteristics demonstrated when the ratio of y and x in Al_xO_y film was closer to 1.5, the barrier property was better and horizontal, vertical elastic modulus and yield strength were greater. In addition, the mechanical characteristics of Al_xO_y/PET films significantly changed as the films were stretched, there were two significant turning points in stress-strained curve.

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