高效节能型聚对二甲苯真空镀膜设备研制及其在农业领域的应用

李志胜[1],刘小江[2],段玉权[3],林　琼[3],王晓冬[4]

(1.北京胜泰东方科技有限公司,北京　102400;2.沈阳工业大学机械工程学院,辽宁　沈阳　110870;
3.中国农业科学院农产品加工研究所,北京　100905;4.东北大学机械工程与自动化学院,辽宁　沈阳　110819)

摘　要:随着聚对二甲苯(Parylene)镀膜技术的快速发展和应用,如何有效提高聚对二甲苯材料的利用率、提高成膜质量、降低生产成本等在工业化生产过程中被广泛关注。本文对常规聚对二甲苯真空镀膜设备的结构特点和应用现状进行了详细分析,结合稀薄气体流动特性、传热学及工业化生产需求,设计研制了采用内置裂解加热器的聚对二甲苯真空镀膜设备。同时,根据聚对二甲苯镀膜室特有的环境工况以及膜层可抵御酸碱、盐雾、霉菌的特性,提出了对鲜花和低水分干种子进行镀膜保护的工艺研究,拓展了聚对二甲苯镀膜技术在农业领域的应用。

关 键 词:聚对二甲苯;气相沉积;内置裂解器;干种子

中图分类号:TH69;TB742;S473　　**文献标识码**:A　　**文章编号**:1002-0322(2022)05-0038-07

doi:10.13385/j.cnki.vacuum.2022.05.07

Development of High-Efficiency and Energy-Saving Parylene Vacuum Coating Equipment and Its Application in Agriculture

LI Zhi-sheng[1], LIU Xiao-jiang[2], DUAN Yu-quan[3], LIN Qiong[3], WANG Xiao-dong[4]

(*1.Beijing Standfor Technoloyg Co., Ltd., Beijing 102400, China; 2.School of Mechanical Engineering, Shenyang University of Technology, Shenyang 110870, China; 3.Institute of Agri-food Science and Technology, Chinese Academy of Agriculture Science, Beijing 100905, China; 4.School of Mechanical Engineering and Automation, Northeastern University, Shenyang 110819, China*)

Abstract: With the rapid development and wide application of parylene coating technology, how to effectively increase the utilization rate of parylene materials, improve the quality of the film, and reduce costs has been widely concerned in the industrial production process. In this paper, depending on the structural characteristics and application status of conventional parylene vacuum coating equipment, a type of parylene vacuum coating equipment with a built-in pyrolyzer is developed, in which flow characteristics of rare gas, heat transfer and industrial production requirements are concerned. At the same time, according to the unique environmental conditions of the parylene coating room and the characteristics of the film to resist acid and alkali, salt spray and mold, coating protection for flowers and low-moisture dry seeds is proposed, which will expand the application of parylene coating technology in the agricultural field.

Key words: parylene; vapor deposition; built-in pyrolyzer; dry seed

聚对二甲苯(Parylene)是一种保护性高分子聚合物结晶材料,根据分子结构的不同,可分为N型、C型、D型、F型等[1-4]。聚对二甲苯膜层采用真空气相沉积工艺制备,在特定的真空环境下通过将固体二聚物粉末材料高温汽化,再继续加热使其裂解生成单体活性分子,然后在常温条件下沉积到基材表面聚合生成高分子薄膜。裂解后的单体小分子具有良好的基材适应性和穿透能力,因此能够在形状复杂的工件表面、缝隙及细小通孔等位置生成真正厚度均匀且完全敷形的保护膜层。聚对二甲苯膜层具有优良的隔离性能、电气性能、热性能、化学稳定性和生物相容性,可抵御酸碱、盐雾、霉菌、紫外及各种腐蚀性气体的侵害[5-8]。

收稿日期:2021-11-05

作者简介:李志胜(1977-),男,河北省蔚县人,硕士,高级工程师。