



航空学报 » 2006, Vol. 27 » Issue (6) : 1194-1202 DOI:

论文

最新目录 | 下期目录 | 过刊浏览 | 高级检索

<< Previous Articles | Next Articles >>

### 层合复合材料z-pinning增强技术的力学进展

孙先念, 郑长良

大连海事大学 机电与材料工程学院, 辽宁 大连 116026

### Advances on Modeling Through-the-thickness Reinforcement of Laminated Composite by z-pinning

SUN Xian-nian, ZHENG Chang-liang

Electromechanics and Materials Engineering College, Dalian Maritime University, Dalian 116026, China

摘要

参考文献

相关文章

Download: PDF (835KB) HTML 0KB Export: BibTeX or EndNote (RIS) Supporting Info

**摘要** z-pinning技术是自20世纪90年代中期发展起来的一种增强层合材料层间韧性的新技术。此项技术通过在层合板内嵌入体分比小于5%的z-pin,能使层合板的I型层间断裂韧性提高十几倍,减少50%由低能量冲击所产生的层间分层,并且只造成层合板面内拉压强度的少量退化或不退化。同时,z-pinning技术较之其他层间增强技术,如编织、纺织和缝合技术等,又具有易于加工,且便于控制工艺质量等优点。因此,这一技术在近年来逐渐受到重视,并在一些航空、航天复合材料结构中得到了应用。简要介绍了z-pinning技术的工艺特点,重点综述这一领域细观力学模型与实验测试等力学分析工作的最新进展,并对准确评估z-pin力学行为的研究工作进行了展望。

**关键词:** 层合复合材料 z-pinning 分层 层间增强 分层韧性

**Abstract:** Through-the-thickness reinforcement of laminated composites by z-pinning has attracted more and more attention since the middles of 1990s. The insertion of z-pin, with the volume fraction of fibrous z-pin less than 5%, can lead to an up to 18-fold increase in mode I fracture resistance of the z-pinned polymer composite laminates, with a retention of 91%-98% the tensile and 100% of the compressive strengths. There is also a 50% reduction in the delamination area after the low-energy impact. Compared to the other reinforce technologies, such as weaving, knitting, braiding, and stitching, etc., z-pinning is easier to be manufactured and controlled in its quality, which has been applied to some engineering structures in aerospace industry in recent years. In this paper, the z-pinning technology is briefly described and recent advances on modelling the mechanical behaviour of z-pin is reviewed.

**Keywords:** composite laminates z-pinning delamination interlaminar improvement delamination toughness

Received 2005-06-20; published 2006-12-25

#### 引用本文:

孙先念;郑长良. 层合复合材料z-pinning增强技术的力学进展[J]. 航空学报, 2006, 27(6): 1194-1202.

SUN Xian-nian; ZHENG Chang-liang. Advances on Modeling Through-the-thickness Reinforcement of Laminated Composite by z-pinning[J]. Acta Aeronautica et Astronautica Sinica, 2006, 27(6): 1194-1202.

#### Service

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ Email Alert
- ▶ RSS

#### 作者相关文章

- ▶ 孙先念
- ▶ 郑长良