



航空学报 » 2009, Vol. 30 » Issue (4) :757-762 DOI:

论文

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热压罐成型复合材料复杂结构对制造缺陷的影响规律

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Effect Rules of Complex Structure on Manufacturing Defects for Composites in Autoclave Molding

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摘要

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摘要 飞行器复合材料种类多、结构形式复杂,制造缺陷种类、形成机制及影响因素也较为复杂。基于大量复合材料制件无损检测数据的统计结果,分析了热压罐成型工艺中常见缺陷的类型,揭示了复合材料复杂结构对制造缺陷的影响规律,初步分析了缺陷的产生机制。结果表明,分层、气孔和孔隙是热压罐成型工艺中比例较高的3类缺陷,复合材料制件结构的复杂性直接影响缺陷的出现比例,复合材料制件的几何特征和成型工艺对制造缺陷的影响规律较为明显。研究结果对制造缺陷的控制及复合材料制件结构设计具有重要的指导意义。

关键词: 复合材料 层合板 复杂结构 热压罐成型 缺陷 分层 孔隙

Abstract: The types of composite components applied in aircrafts are different and complex, and the type, formation mechanism, and influence factor of manufacturing defects are also complex. These defects that often arise in autoclave molding are summarized, and the effect rules of complex structure on manufacturing defects are revealed on the basis of statistical analysis of a considerable amount of defect information obtained by non-destructive testing of composite components. Moreover, the formation mechanism is primarily analyzed. It is observed that delamination, pore, and void are the three main defect types in autoclave molding. In addition, the ratio of defect appearance is obviously influenced by the complexity of composite components. Geometric characteristics and the molding process for composite components have significant influence on the type and ratio of defects. The results are valuable for the controlling of manufacturing defects and the structure design of composite components.

Keywords: composites laminate complex structure autoclave molding defect delamination void

Received 2008-01-10; published 2009-04-25

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引用本文:

王雪明;谢富原;李敏;戴棣;王菲;张佐光. 热压罐成型复合材料复杂结构对制造缺陷的影响规律[J]. 航空学报, 2009, 30(4): 757-762.

Wang Xueming; Xie Fuyuan; Li Min; Dai Di; Wang Fei; Zhang Zuoguang. Effect Rules of Complex Structure on Manufacturing Defects for Composites in Autoclave Molding[J]. Acta Aeronautica et Astronautica Sinica, 2009, 30(4): 757-762.

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