等离子体处理对氰酸酯基复合材料表面性能影响研究 *

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摘　要: 采用等离子体处理技术对不同作用距离下的石英纤维/氰酸酯复合材料表面进行活化处理,考察了等离子体处理工艺参数对复合材料表面接触角的影响,以及等离子体处理前后表面形貌、性能和膜基结合强度的变化规律。研究结果表明:经氮气、氩气等离子体处理后,复合材料表面接触角明显减小,均随作用距离减小呈下降趋势,且氩气的活化效果比氮气的好;工艺参数对复合材料表面接触角影响重要程度依次为气压、电压、时间,在一定范围内增加气压、电压,延长处理时间,复合材料表面接触角变小,活化效果越好;等离子体处理后,复合材料的玻璃化转变温度(T_g)和弯曲强度无变化,没有损伤复合材料的本征性能;等离子体处理后,复合材料表面粗糙度和比表面积增大,复合材料与 Al 镀层的膜基结合强度显著提升。

关　键　词: 氰酸酯基复合材料;等离子体;接触角;表面形貌;本征性能;膜基结合强度

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Influence of Surface Plasma Activation on Cyanate Ester Composites

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Abstract: The surface of the quartz fiber/cyanate ester composite material at different working distances was activated by plasma treatment technology. The influence of plasma treatment parameters on the surface contact angle of the composite was investigated, as well as the changes of surface morphology, the intrinsic performance and membrane-based bonding strength before and after plasma treatment. The results show that the surface contact angle of the composite material decreases significantly after plasma treatment with nitrogen and argon, and decreases with the decrease of action distance. Moreover, the overall activation effect of argon is better than that of nitrogen. The important degree of influence factors of process parameters is in order of air pressure, voltage and time. If the air pressure and voltage are increased in a certain range and the treatment time is extended, the surface contact angle of composite material becomes smaller and the activation effect is better. The glass transition temperature and bending strength of the composites is unchanged, showing that the intrinsic performance of the composites are not damaged before and after plasma treatment. After plasma treatment,the surface roughness and specific surface area of the composite increase, and the membrane-based bonding strength of the composite with Al coating increases significantly.

Key words: cyanate ester composites; plasma; contact angle; surface morphology; intrinsic performance; membrane-based bonding strength

树脂基复合材料具有高比强度和比刚度、轻质及良好的力学性能等特点,能有效减轻航空航天器的结构质量,增加有效载荷,是当今宇航材料的发展重点,正逐渐取代传统的金属和合金材

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