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竹粉/聚丙烯发泡复合材料加速老化性能的研究

Performance of bamboo flour/polypropylene foamed composite under accelerated weathering

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中文摘要:

为改善木塑复合材料密度大、韧性差的缺陷，采用注塑法制备竹粉/聚丙烯（polypropylene，PP）发泡复合材料；同时为加强木塑材料的生产和质量管理，采用氙灯老化方式，研究老化对发泡复合材料力学性能、材色、流变性能的影响，并采用环境扫描电镜（environmental scanning electronic microscopy, ESEM）和傅里叶红外光谱ourier transform infrared spectrum, FTIR）对材料进行分析。结果表明：历时1 200 h氙灯加速老化后，材料的弯曲强度、弯曲模量和缺口冲击强度的保留率仅分别为79.4%8.3%和75.6%；产生的色差ΔE*和白度变化值ΔL*分别为49.0和48.4。频率扫描结果显示，老化后，复合材料的模量和黏度下降。ESEM显示，老化后材料表面出现孔洞和缝，且部分竹粉暴露在材料表面。FTIR结果表明，老化过程中，复合材料发生了光氧化降解反应。该研究可为进一步探索竹塑发泡复合材料的老化规律，制定产品标准供试验数据和理论参考。

英文摘要:

Abstract: In order to reduce the density and improve the toughness of wood-plastic composite (WPC), the foamed WPC was made through adding chemical foaming agent in study. To fully utilize bamboo resources in China and reduce white pollution, the foamed composite with 54% PP and 13% HMSPP containing 33% bamboo powder and 1% modif azodicarbonamide (AC) foaming agent blends by weight was made by injection molding. Furthermore, the aging performance of bamboo powder/polypropylene (PP) foamed composites was studied in order to investigate the weathering mechanism of WPC and to strengthen its production and quality management and thus expand its application fields composites were exposed to 1 200 h accelerated xenon-arc radiation with water spray, the mechanical characteristics including bending performance, notched impact strength, and color change of composites were studied. The rheological behavior of composites with regard to frequency sweep ranges from 0.01 to 70 Hz at 195℃ was observed. The surface morphology of composites with non-weathered and weathered for 1 200 h were investigated by ESEM and their chemical structures were analyzed by FTIR. The results showed th the mechanical properties of composites decreased significantly for weathering 300 h and decreased continuously with an increase of exposure time. The retentions of residual be strength, flexural modulus and notched impact strengths were only 79.4%, 68.3% and 75.6% respectively. The weathering also resulted in significant color fading of the composite especially for the first 900 h. The color began to change slowly within the next 300 h. After weathering for 1 200 h, the color change ΔE*, lightness change ΔL*, redness change Δa and yellowness change Δb* were 49.0, 48.4, -5.9 and -4.9 respectively. The frequency sweep results indicated that the storage modulus, loss modulus and complex viscosity of composite weathered for 1 200 h decreased and the intersection value of energy storage modulus and loss modulus become lower, and the corresponding frequency was higher. T results indicated that the molecular weight distribution become wider and the molecular weight became lower. The ESEM observation revealed that the surface of weathered comp was no longer smooth; and the cracks and holes appeared and some bamboo fibers exposed. The FTIR analysis showed the new peak of C=O stretching vibration at 1 717 cm-1 appeared and C=C absorption peak at 1 459 cm-1 strengthened and C=O stretching vibration peak at 1 059 cm-1 also strengthened. The FTIR result verified the photooxidation and photodegradation of composites for accelerated weathering.

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