一般論文

鉄道コンテナ輸送における振動条件を考慮した段ボール箱の荷擦れ発生メカニズム

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Mechanism of Abrasion Damage in Corrugated Boxes Considering the Vibration Condition During Railway Container Transportation

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鉄道コンテナ輸送における荷擦れ発生メカニズムの解明を目的とした輸送環境調査において、12 フィートコンテナを対象とした鉄道輸送における振動加速度 PSD では、左右方向の低周波成分、上下方向の低周波成分および高周波成分が大きいことを確認していた。さらに本報では、鉄道輸送の振動加速度 PSD を用いた定置加振試験を実施し、左右方向（低周波のみ）に上下方向（高周波のみ）を加えた 2 軸同時加振で顕著な荷擦れが発生することを確認した。輸送環境調査および定置加振試験結果を踏まえ、鉄道コンテナ輸送における荷擦れ発生メカニズムは、まず貨車運動特性に起因する左右方向の低周波振動により貨物がロッキング挙動することで荷擦れが発生し、さらに貨車用まくらばね自体の共振を主とする上下方向の高周波振動によりロッキング挙動が発生しやすくなり、荷擦れ量が増大すると考察した。

In order to elucidate the mechanism of abrasion damage in corrugated boxes during railway container transportation, we previously conducted a transportation test. In the railway transportation test with a 12-ft container, we found that the power spectral density (PSD) of lateral acceleration was large in the low-frequency band, whereas that of vertical acceleration was large in both the low-frequency and high-frequency bands. Furthermore, in this paper, we conducted the vibration test with PSD of vibration acceleration during railway transportation, we found that significant abrasion damage occurred with simultaneous excitation in two axes, including the lateral direction (low-frequency only) and the vertical direction (high-frequency only). Based on the above results, we conjectured that the mechanism of abrasion damage in corrugated boxes during railway container transportation is as follows. First, low-frequency vibrations occur in the lateral direction due to the characteristics of freight car motion. These vibrations cause the freight to undergo rocking motions, causing abrasion damage. Moreover, high-frequency vibrations in the vertical direction caused by surging in secondary springs of the freight car induce rocking motions and increase the amount of abrasion damage.

キーワード：輸送、鉄道、加速度、振動試験、段ボール箱、荷擦れ

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