新保　實*，宮野　靖*，高橋　佳弘**，村井　曜**

Effects of Adhesive Layers on Residual Stress Generated in Copper Foil of Copper Clad Laminates

Minoru SHIMBO*, Yasushi MIYANO*, Yoshihiro TAKAHASHI** and Hikari MURAI**

＊金沢工業大学ものづくり研究所（ 924-0838　石川県白山市八束穂3-1）
＊＊日立化成工業株式会社新材料応用開発研究所（ 308-8521　茨城県筑西市小川1500）
　＊Research Laboratory for Integrated Technological System, Kanazawa Institute of Technology (3-1 Yatsukaho, Hakusan-shi, Ishikawa 924-0838)
　＊＊New Applied Materials R&D Center, Hitachi Chemical Co., Ltd. (1500 Ogawa, Chikusei-shi, Ibaraki 308-8521)

概要　本研究は，銅張積層板（銅箔／FRP／銅箔）の銅箔部に生ずる残留応力に及ぼす多層化接着剤ならびに内層材の影響について検討した。具体的には，まず種々の接着剤ならびに種々の内層材を用いて銅張積層板をホットプレス法で成形した。ついで，これら積層板の銅箔部の残留応力を逐次除去のひずみゲージ法により求めた。さらに，接着剤ならびに内層材の熱的，機械的特性を測定し，銅箔部の残留応力をこれら諸特性とともに考察した。その結果以下のことを明らかにすることができた。

(1)銅箔部に生ずる残留応力は，銅箔の線膨張係数よりも鏡板と接着剤ならびに内層材の線膨張係数に大きく影響を受け，以下(I)<(II)<(III)の順に大きくなる。

(I) $\alpha_P = \alpha_A = \alpha_F$

(II) $\alpha_F < \alpha_P < \alpha_A$ または $\alpha_A < \alpha_P < \alpha_F$

(III) $\alpha_P < \alpha_F < \alpha_A$ または $\alpha_P < \alpha_A < \alpha_F$，$\alpha_F < \alpha_A < \alpha_P$ または $\alpha_A < \alpha_F < \alpha_P$

ここで α_P：鏡板の線膨張係数，α_A：接着剤の線膨張係数，α_F：内層材の線膨張係数

(2)銅箔部に生ずる残留応力は，接着剤の線膨張係数を制御することで低減することが可能である。

Abstract

This study examined the effects of multi-ply adhesive and an insulating layer on the residual stress generated in the copper foil portions of a copper clad laminate composed of copper foil/FRP/copper foil. First, copper clad laminates were formed by the hot press method using various multi-ply adhesives as well as various insulating layers. Then, residual stress in the copper foil portions of these samples was measured by the strain gauge method of the layer-removing. The thermal and mechanical properties of the multi-ply adhesive and the insulating layer were measured, and the residual stress of the copper foil portion was analyzed together with these various properties. The following results were identified:

(1) The residual stress generated in the copper foil portion depends more on the coefficient of linear expansion of the mirror plate, multi-ply adhesive, and insulating layer than on that of the copper foil. And, it grows hereafter in order of (I)<(II)<(III).

(I) $\alpha_P = \alpha_A = \alpha_F$

(II) $\alpha_F < \alpha_P < \alpha_A$ or $\alpha_A < \alpha_P < \alpha_F$

(III) $\alpha_P < \alpha_F < \alpha_A$ or $\alpha_P < \alpha_A < \alpha_F$，$\alpha_F < \alpha_A < \alpha_P$ or $\alpha_A < \alpha_F < \alpha_P$

Where, α_P: coefficient of linear expansion of mirror plate, α_A: coefficient of linear expansion of adhesive, α_F: coefficient of linear expansion of insulating layer.

(2) The residual stress generated in the copper foil portion can be reduced by controlling the coefficient of linear expansion of the multi-ply adhesive.

Key Words: *Copper Clad Laminate, Adhesive, Residual Stress, Thermoviscoelastic Property, Hot Pressing*