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Observation on Deformation Behavior of Paper Honeycomb Sandwich Board using In-situ X-ray CT

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Paper honeycomb sandwich structures are used as an interior material for automobiles in Fig.1, because of its superior specific stiffness and specific strength. In this paper, it is important to clarify the internal deformation under the required loading conditions for the model-based development of trunk boards. Therefore, the internal deformation of the GFRP's face plates and the paper honeycomb core panels, which constitute the trunk board were observed by X-ray 3D-CT testing. Two specifications of the GFRP's face plates and the paper haneycombcore panels are in Table 1. The face plates are composed of glass fiber and polyurethane, and the paper honeycomb cores are bonded to the face plates with polyurethane.

The face plates are subjected to the tensile test and the paper haneycombcore panels subjected to a three-point bending test while in-situ X-raying was performed. Tensile test results showed buckling and fracture at the glass fiber voids, as confirmed by X-ray CT imaging. The results of 3-point bending test showed buckling in the polyurethane- impregnated area of the honeycomb core, as confirmed by X-ray CT imaging. Consequently, it was found that the non-uniformity of glass fibers in the face plates and the impregnation state of the surface resin material into the honeycomb section is an important factor in the mechanical properties.

The effect of the buckling of the honeycomb core materials on the stiffness and strength of the entire boards is an issue to be investigated in the future, and this findings will be applied to the study of the model-based development of the paper honeycomb panels.

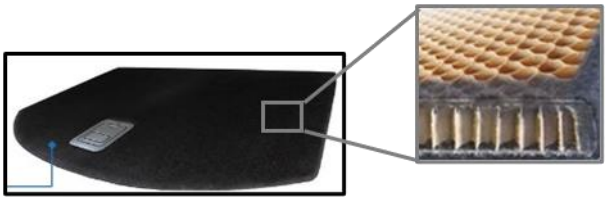
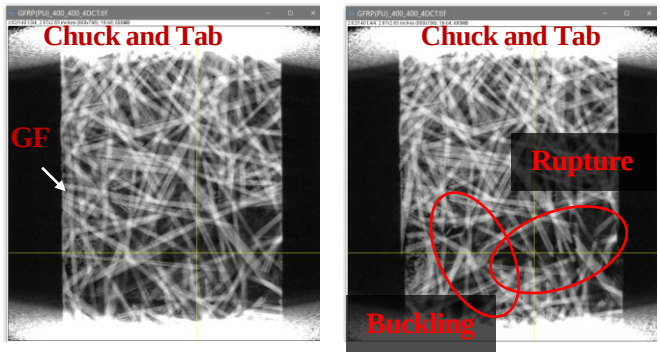


Fig.1 Paper Honeycomb Sandwich Board for Automotive Interiors.

Table.1 Specs of Test pieces in 3-point bending test

		Test piece A	Test piece B
Face Plates	Basis weight of Glass fiber	400g/m^2	400g/m^2
	Basis weight of Polyurethane	400g/m^2	600g/m^2
Paper Honeycomb Core	Thickness	0.244mm	0.244mm
	Height	18mm	18mm
	Honeycomb Radius	Φ12mm	Φ12mm
	Basis weight of Paper	160g/m^2	160g/m^2
Size	Width x Length	50 × 200mm	



(a) Before Breaking (b) After Breaking

Fig.2 Deformation Fracture in Test Piece A (Tensile test)

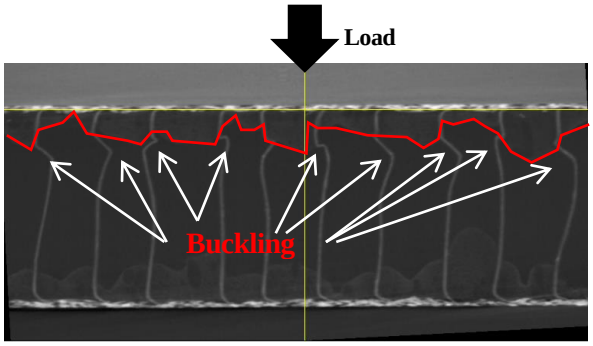


Fig.3 X-ray imaging Polyurethane impregnation in Test Piece A