Mechanoluminescent study for optimization of joint design on cross tension test

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Introduction

- 【**Mechanoluminescent (ML) sensing**】 Visualization of dynamic stress/strain distribution via luminescence
- 【**Application**】Detection of stress concentration and crack generation/propagation (Metal, Polymer, CFRP etc)
- 【**Potentially application**】Design supporting and CAE Solicitation tool based on stress visualization

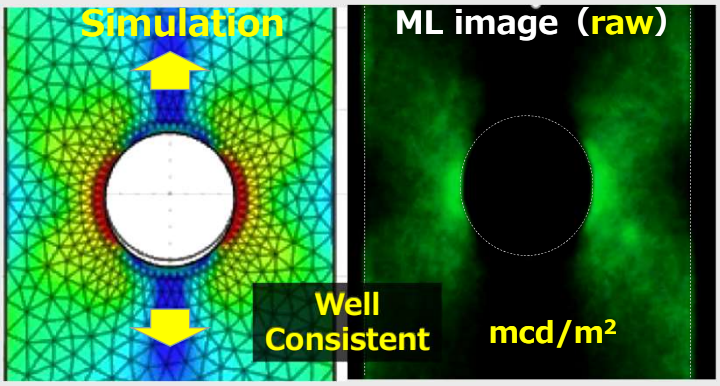


Fig. 1. ML result and simulation on stress distribution

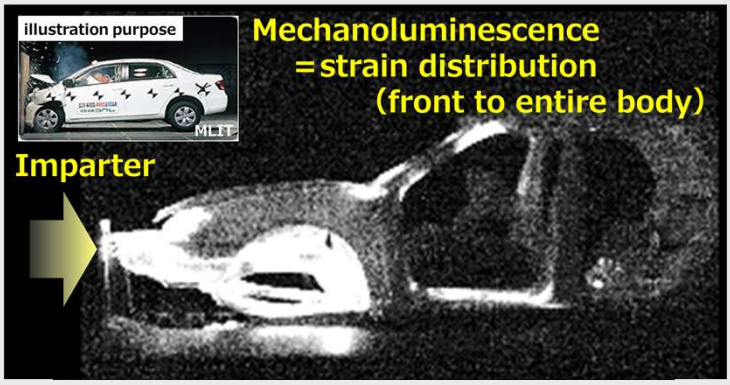


Fig. 2 ML visualization of mechanical behavior at crash of car body

Results

【1】Motivation International standard

We have visualized mechanical behavior on various widely used adhesive test in international standard to clarify the meaning of each INDEX.

This work

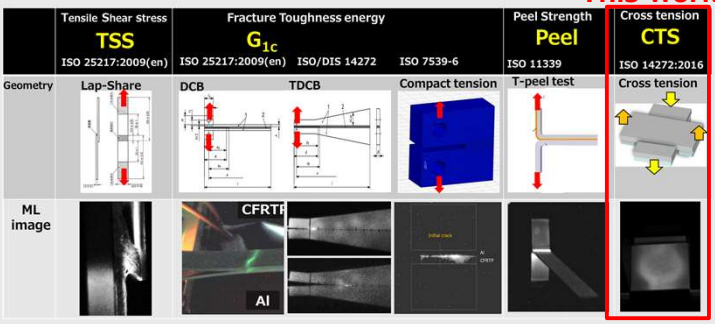
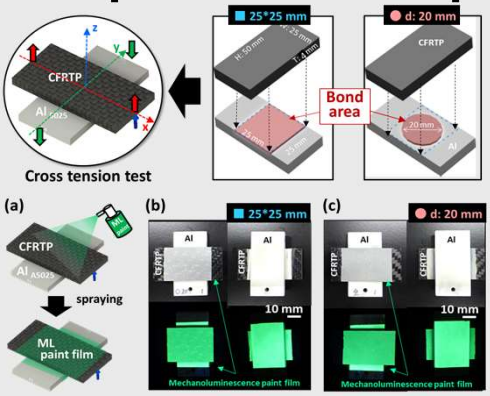


Fig. 4. ML visualization during international standard test

【2】Specimen & Preparation



CT specimen is consisting with CFRTP, Al (A5052) and epoxy adhesive. 2 types of shape was tried for bonding area (Square and round). ML paint was sprayed to prepare ML sensing film on the surface of the CT specimens.

Fig. 5. CT Specimens for ML measurement

【3】Evaluation of joint design on Ct cross-tension test through ML

CT specimens with round shape bond area show low scattering in CTS values. During load application, in the CT specimens, ML circle of the same size appeared and gradually became smaller, reflecting stable and uniform crack propagation from entire edge of bonding area. On the other hand, ML patterns are different among CT specimens with square bond area, reflecting ununiform crack propagation.

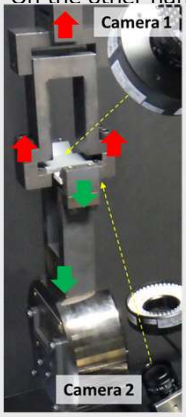


Fig. 6. Photo

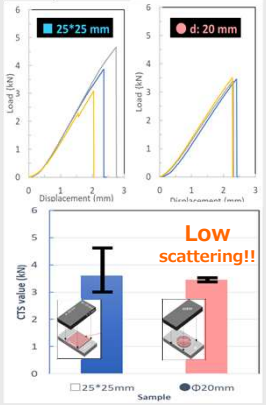


Fig. 7. CTS values

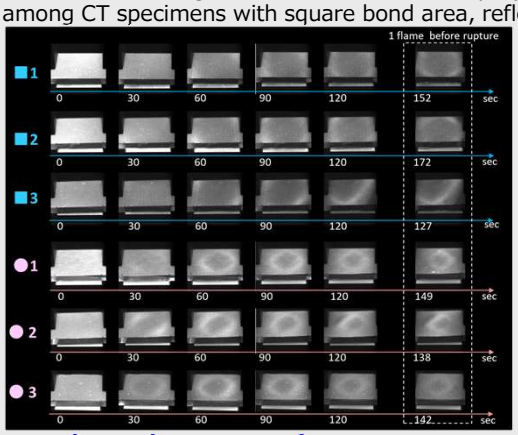


Fig. 8. Time course of ML patterns.

Fig. 9. Photos of fracture surface.

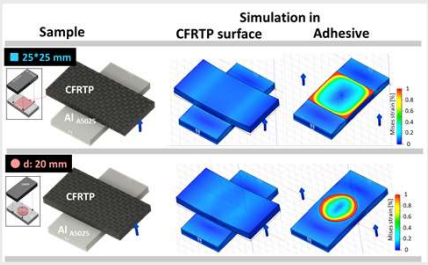


Fig. 10. Simulation in CFRTP and adhesive

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