Low-velocity impact response of thermoplastic composite sandwich panels with the intersected corrugated core

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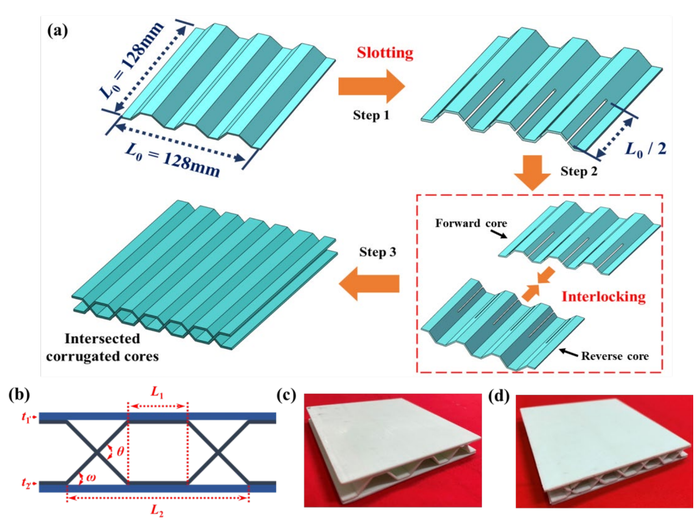
◆Introduction

Thermoplastic composites (TPC) are receiving increasing attention because of their advantages of reprocessing and recyclability. Nevertheless, research on the performance of TPC sandwich structures under impact loading is still in the basic stage. In addition, many studies have shown that impacts occurring at long span of corrugated cores have a significant effect on structural performance. In this work, a novel intersected corrugated sandwich panels (ICSPs) were fabricated by a simple but efficient slotting and interlocking methods. Through the drop-weight tests and finite element simulations, the low-velocity impact response of TPC-ICSPs was investigated and compared with regular corrugated sandwich panels (TPC-RCSPs) subjected to impacts at different locations. Furthermore, the effects of staggered angles on the impact resistance of ICSPs were discussed. The results show that impact on the long span causes greater structural damage to the RCSPs, the ICSPs are considered to have better impact resistance and could provide a new idea for the protection structure design.

◆Specimen fabrication

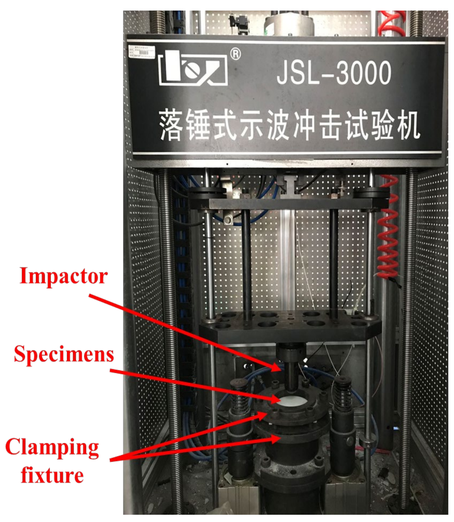
➢Hot-melting method

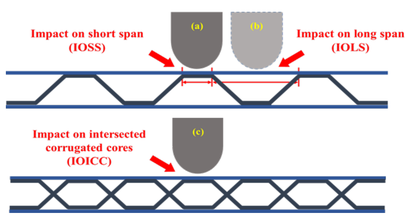
➢Slotting and interlocking techniques



◆Methods

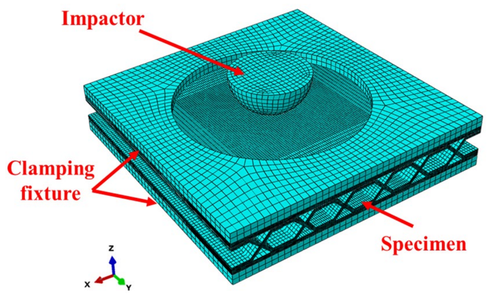
➢Drop-weight tests

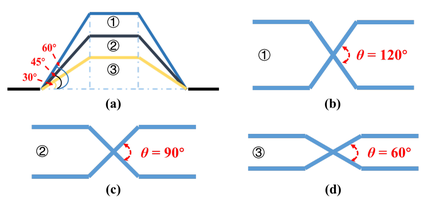




Different impact conditions

➢FE model





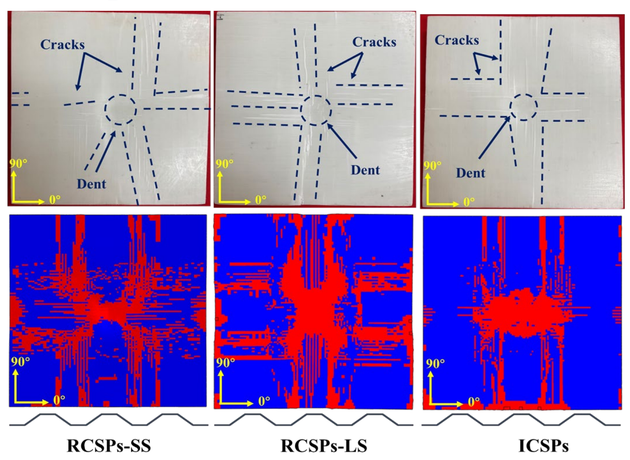
Different staggered angles

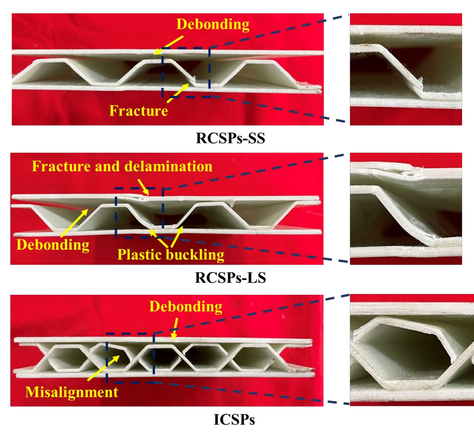
- Meshed with C3D8R.
- Cohesive contact between face-sheet and core.
- 3D-Hashin failure criteria and stiffness degradation.

◆Result & discussion

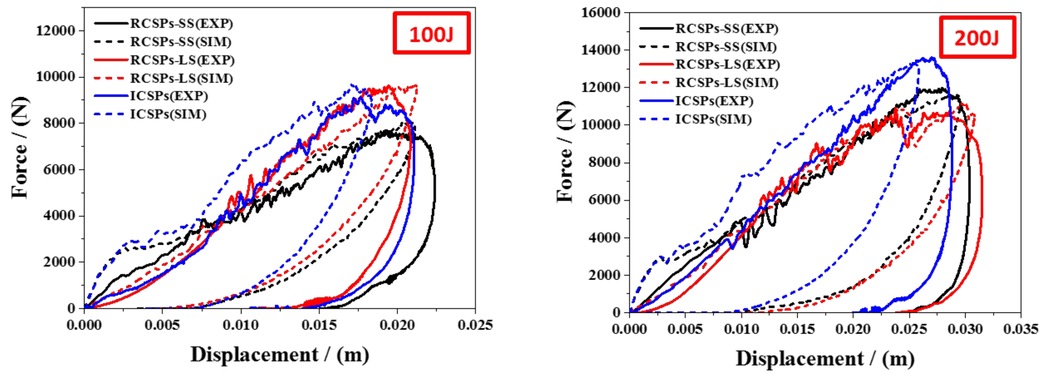
➢Comparison of RCSPs and ICSPs

- Damage mode



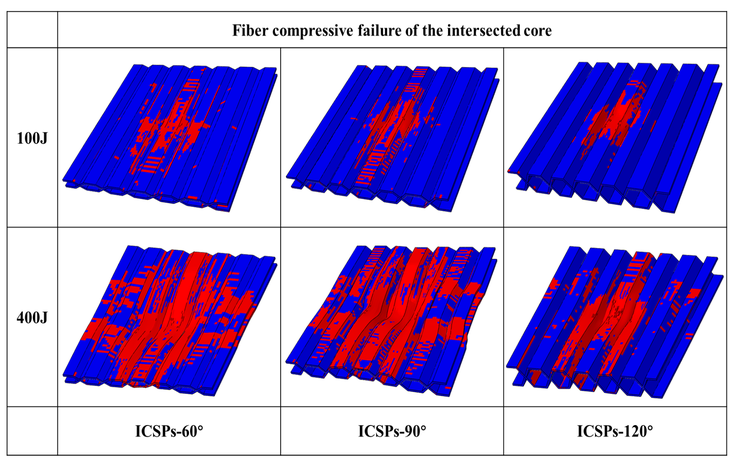


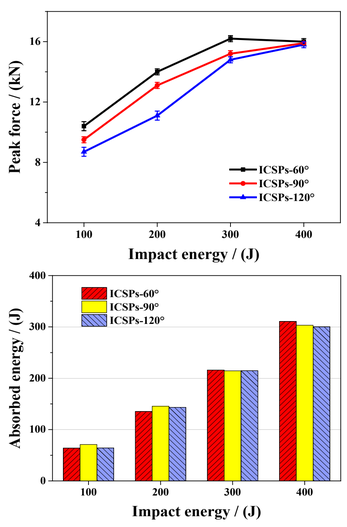
- Load-displacement curves



- Compared to RCSPs, ICSPs have less damage and better load-carrying capacity. ICSPs are able to maintain good structural integrity after impact.

➢Effect of staggered angles of ICSPs





◆Conclusions

1. The impact location has a visible effect on the response process and damage mode of the RCSPs. Compared to RCSPs, the design of intersected corrugated core effectively weakens the effect of impact location on structural damage and load-carrying capacity without increasing the thickness of the structure.
2. At the impact energy of 200 J, the ICSPs structure has a comparable energy absorption capacity to the RCSPs, but its peak force is 15.3% and 21.4% greater than that of the RCSPs-SS and RCSPs-LS respectively.
3. The core damage mode of ICSPs with small staggered angles changes from local buckling to global bearing with the increase of impact energy.

◆Acknowledgments

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