Investigation on the influence of temperature, pressure and curing time on the mechanical properties of metal skins and CFRP core sandwich panels manufactured by means of curing-by-stamping process

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Abstract. Sandwich panels made of metal skins (MS) and fiber reinforced polymer core (FRPC) are largely utilized in the aeronautic and aerospace industry thanks to their high-specific mechanical properties and the good thermal and acoustic insulation although some attempts have been also made to utilize sandwich panels in the automotive industries. The laminate structure acquires a high flexural resistance, which is one of the key point for safety components in automotive applications in the core of the laminate structure, a lightweight material is utilized, reducing the overall weight. the relatively-long curing time of the thermoset matrix of the FRPC is the main reason for the low-scale utilization of these materials in the vehicles manufacturing. In this research, a combined curing-by-stamping process is proposed to quickly manufacture sandwich panels made of MS and CFPC and the in fluence of the stamping mold temperature(T_M), stamping pressure (P_M) and the process time (C_T) are investigated to correlate them with the mechanical properties of the stamped panels. The panel is realized with AISI-304 steel, the core with high modulus-CF ($0^o/90^o$) woven, and a thin Loctite 9460 and 3M-DP420 epoxy-based structural adhesive layer in their between to increase the bonding strength. Rectangular specimens have been cut from the manufactures plates and tested in 3-point bending test analyzing the variation of bending modulus and bending strength according different combinations of T_M,P_M and C_T, allowing to define a processing map correlating process conditions and panel mechanical properties. According to the results, stiff and well-cured MS-CFRP panels can be manufactured in approximately 300s and present bending mechanical properties from 1.5 to 2 times higher than those of the steels utilized for their skin.

Fig. 1 MS-FRPC material concept.

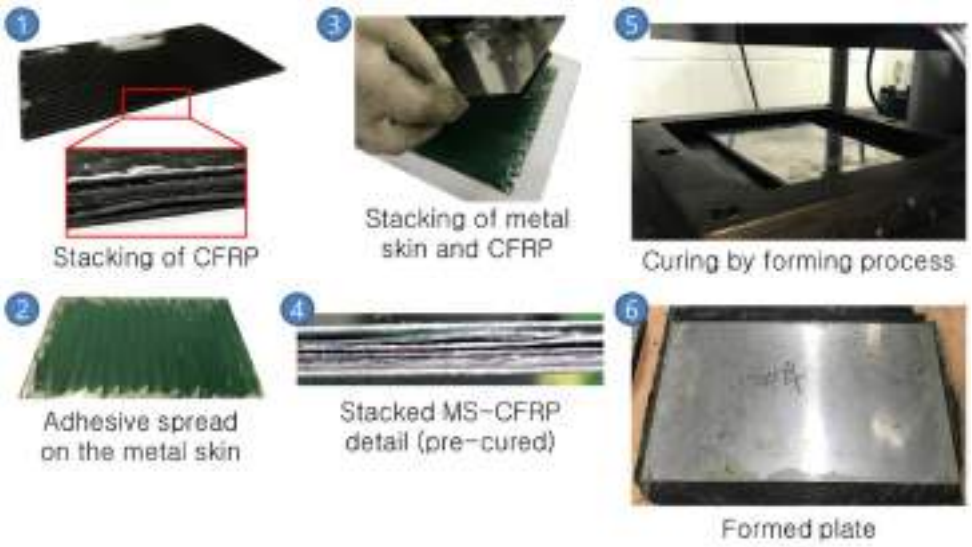

Fig. 2 Curing-by-stamping process phases.

Fig. 3 MS-FRPC specimen undergoing the 3-point bending test.