THERMOGRAPHY AND SHEAROGRAPHY INSPECTION OF COMPOSITE HYBRID SANDWICH STRUCTURE MADE OF CFRP AND GFRP CORE AND TITANIUM SKINS

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Composite materials are well established now as materials for constructing aircraft structures, as a replacement of metal, mainly for their lower weight, high strength and resistance to corrosion. Besides the development of materials and structures, specific nondestructive inspection (NDI) techniques are studied actively, in order to detect and identify damages which are specific to these materials. Full composite structures however do not always comply with some specific requirements and hybrid structures, incorporating both composites and metals, are still necessary. In such case, adapted NDI must also be studied and assessed.

In this work, we used as reference sample a sandwich structure typically 5 mm thick and composed of a core made epoxy reinforced by carbon and glass fibers, with skins of Titanium adhering to the former through epoxy adhesive. The plane sample incorporates Teflon inserts as artificial defects simulating delamination in Ultrasound Testing (UT), as well as air gaps (lack of epoxy), of different diameters and depths. UT did not provide satisfactory results due to the small because of geometry and materials. Therefore we have studied alternatives such as thermography and shearography. For thermography, methods of excitations such as induction, vibration, modulated laser, modulated lamps and flash lamps were used. Mainly lamp heating provided the best results, showing half of the defects: those located close to the surface inspected. In the case of shearography, methods of excitations such as lamp heating, vibration and pressure variation (vacuum vessel) were used. Mostly vibration provided the best results in the case of vibration excitation for the air-gap defects.