Non-Destructive Bond Quality Assessment of CFRP Structures – Status and Way Forward

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Abstract

In order to ensure the performance of load-critical adhesive bonded CFRP primary structures, an innovative way of quality assurance is introduced based on Extended Non-Destructive Testing (ENDT) and Structural Health Monitoring (SHM). The principle of Extended NDT is based on the characterisation of selected physico-chemical properties that are governing the performance of an adhesive bond. The principle of Structural Health Monitoring relies on the detection, localisation and assessment of impacts, damages and stress/strain by means of physical sensors which are permanently installed in the aircraft structure.

In the presentation, both the approach and the complementary role of ENDT and SHM in the field of bond quality assurance are explained. Latest ENDT development results are presented regarding the characterisation of contamination on adhered surfaces prior to bonding and regarding the assessment of thermal degradation in CFRP structures. Furthermore, the feasibility for the detection of ‘weak bonds’ / ‘kissing bonds’ in bonded CFFP structures is shown. With respect to SHM, latest development results are presented regarding the detection, localisation and assessment of impact, debonding and delamination in CFRP structures of current and future aircraft programmes.

Last but not least, the needs and the approach for a time and cost effective technology development are pointed out.