German Armed Forces

BAAINBw / WIWeB (Bundeswehr)

Erding, Germany

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Presentation Title

Nanotechnology adhesive bonding for carbon fiber reinforced plastics (CFRP) in aerospace structures - mission (im)possible ?

Abstract

Structural adhesive bonding of CFRP is of great interest for future lightweight aerospace constructions. Due to previous incidences followed by increased certification hurdles, the goal seems to be far out of reach. The Achilles heel of adhesive bonds is the adhesion itself and there is and there will probably be no non-destructive testing method (NDT) to test the quality of the adhesion achieved within a bond. In consequence, aircraft manufacturers are neglecting to use the weight saving potential of adhesive bonding.
This contribution will give an example of a highly reliable (and therefore robust) adhesive bonding process. From the author's point of view, the key element of reliable adhesive bonding is proper surface treatment. In this talk, we summarize and discuss current results from our research on surface treatment, ageing and destructive testing of bonded CFRP joints. Based on these results a military aerospace demonstrator (airbrake) was fabricated and qualified, including flight trials to demonstrate the feasibility of reliable adhesive bonding processes.

(shortened - pls. see proceedings)

The presentation includes also activities for the repair of used CFRP aircraft structures. For structures made of carbon fibre reinforced plastics (CFRP) robust, fast and reliable repair technologies are mandatory for economic usage. A key factor for the quality of bonded repairs is the scarfing and surface treatment process of the composite structures. Currently and for the past decades, most of the repair areas were simply prepared by manual grinding processes, which produce neither reliable nor robust surfaces for adhesive bonding. Here we present a new automated repair process, based on a portable lightweight 5-axis milling machine that allows fast, economic and reliable repairs of CFRP aerospace structures.

Biography

Today, Dr.-Ing. Jens Holtmannspötter is co-ordinating all the activities to introduce and use additive manufacturing for the German Armed Forces. Besides he is leading a small research group in the German Armed Forces research institute for fuels, materials and lubricants (WIWeB) and is lecturer at the university of the armed forces (UniBw). Dr. Holtmannspötter has studied aerospace technologies at the UniBw in Munich and information technology in Trier.

Main Research and Professional Experience

1996-2009	technical officer of the German Airforce (combat aircraft development / liaison officer in Germany and Italy)
since 2009	civil servant of the BAAINBw
2006-2010	research assistant for structural adhesive bonding at WIWeB / UniBw
2010-2015	head of WIWeB department surface technology
2015-2017	head of WIWeB department NDT (non-destructive testing), joining technologies, additive manufacturing

About WIWeB

Since 1959, the Bundeswehr Research Institute for Materials, Fuels and Lubricants has been part of the BAAINBw organization. It is located in Erding, Bavaria. WIWeB develops and implements the scientific and technological methods and principles required for the study and evaluation of materials, fuels and lubricants as well as textiles and chemicals, with special focus on the practical aspects of their chemical, physical and safety-relevant properties.