

Process and Health Monitoring offered by AAC

For the reduction of weight, the concept of „Damage Tolerant Design“ has been successfully implemented in the aerospace industry since several decades. This concept is based on the idea, that a certain number of defects can be tolerated in a structural component, before it has to be repaired or exchanged. To guaranty the structural integrity of such a component continuous non-destructive inspection have do been done, leading to down times of aircrafts. In addition, the number of structural components made of CFRP has been increased strongly in the last decade, but their potential has not been exhausted due to uncertainties in the production process and the prediction of the residual life (higher safety factors compared to metal structures).

If such a non-destructive inspection system could be permanently applied to structures of interest specially to composite structures and operated online (Structural Health Monitoring), especially in distributed and difficult to access areas, a strong reduction in the down time and subsequent costs of maintenance and also a reduction in weight could be expected.

Besides the monitoring of the usage, process monitoring of automated production process such as resin infusion of polymer composite structures became important. Therefore, concepts for integrated process- and structural health monitoring for high quality structures are required.

AAC is developing methods and sensors for production process monitoring as well as concepts and algorithms for the off- and online damage detection, quantification and residual life time prediction for composite structures based on passive and active ultrasonic methods like Acoustic Emission, Guided Ultrasonic Waves and Phased Array Ultrasonic waves together with local strain approaches measured by distributed fibre optic sensors.

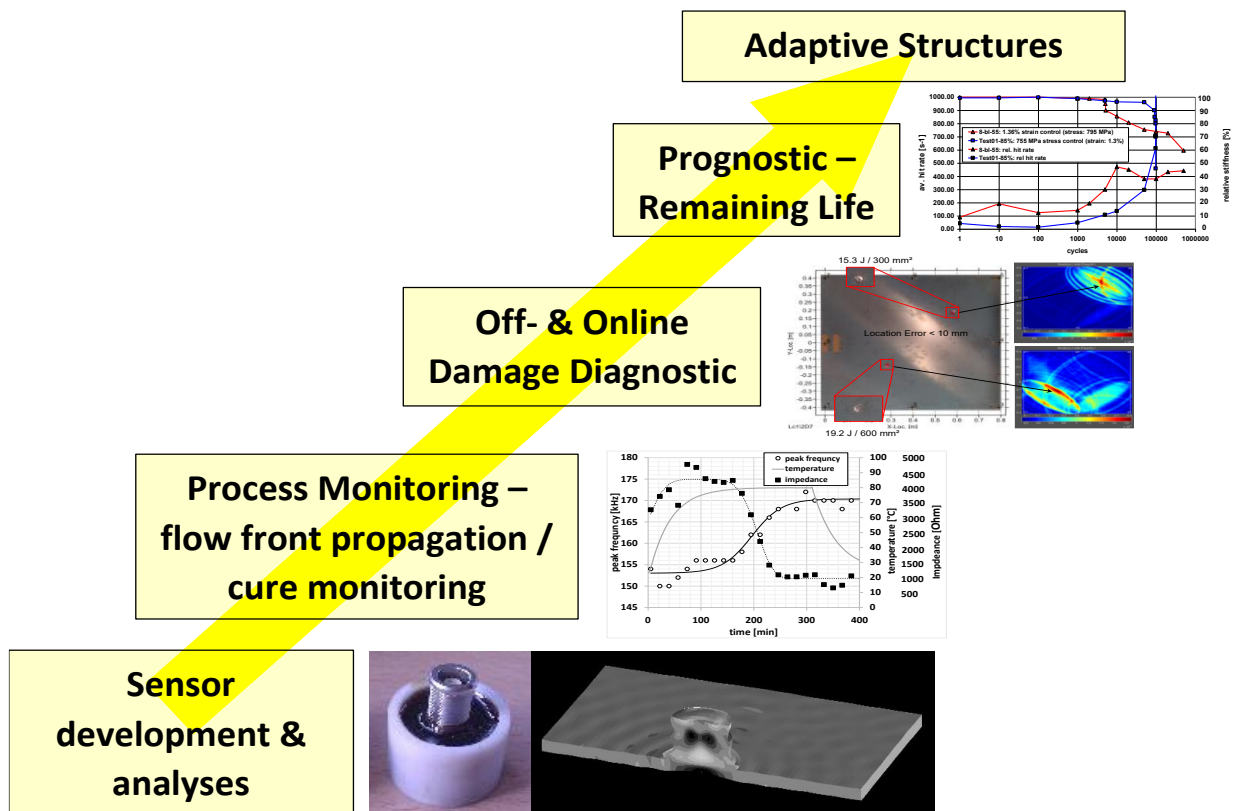


Figure 1: Building blocks for Composite Process and Health Monitoring based on Piezo Sensors



Figure 2: AAC Piezo Sensor and parts with integrated AAC Sensors for production and usage monitoring

The following data acquisition systems are available at AAC

Sensors and Data Acquisition Systems @ AAC	
Piezo Sensors	AAC developed Hybrid Piezo / Temperature Sensor for flow front, cure and Structural Health Monitoring
Acoustic Emission	6 AE channel acoustic emission system AMSY 5 from Vallen with 2 parametric channels)
Hybrid Acoustic Emission / Guided Wave System	Combined hybrid active (guided ultrasonic wave) / passive (acoustic emission) SHM system from Physical Acoustics (8 AE channels / 4 multiplexed signal generation channels / 8 parametric channels)
Impedance Spectroscopy	LCR meter for impedance spectroscopy (cure monitoring)