

ZCO-74, "Examination of Zinc-Coated 'Sandwich Steels' Construction"

Objective:

1. Survey possible sandwich constructions that could be used in automotive applications where high stiffness and damping are required. The outer layers of the sandwich would be galvanized steel sheet, while the inner core is expected to be a lighter-weight material that is stiffer than galvanized steel that could be compatible with continuous processing techniques.
2. After completing the initial survey, model samples would then be prepared and subjected to appropriate deformation and joining operations expected to be used in such applications.

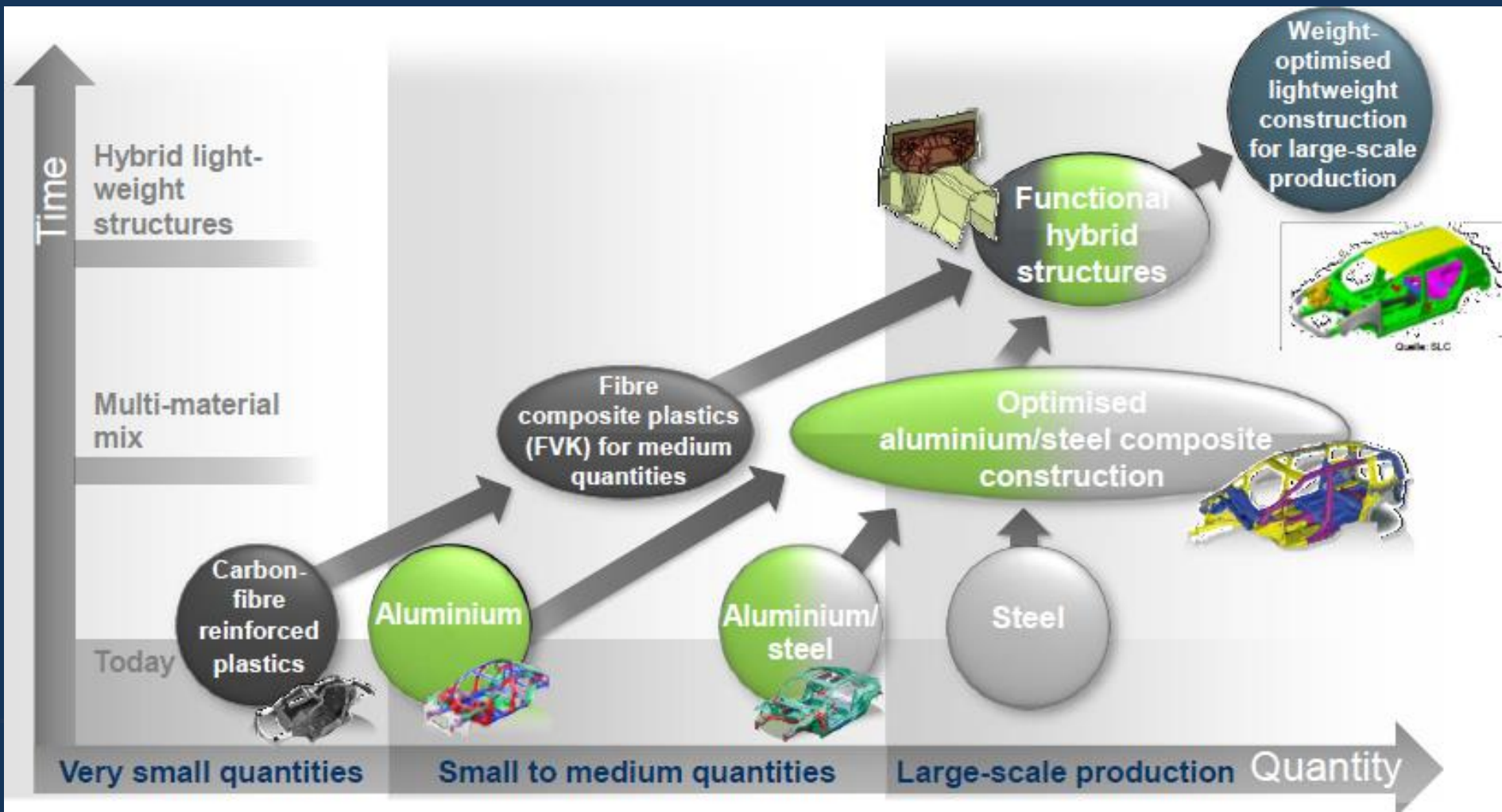


Current Status

- Efforts to initiate this program at KTH-Stockholm have been unsuccessful
- 2 other candidates approached with help of our friends from Salzgitter:
 - Clausthal Centre of Material Technology (CZM)
 - “Open Hybrid Factory” in Wolfsburg, Germany, a public-private partnership involving Univ. of Braunschweig



Materials Evolution, from Open Hybrid Factory



News from this morning

- Our feasibility-check based on results of former projects showed that the before mentioned concept has great potential of success. A closer aim would be producing thin-film oxide or nitride layers with DBD-Plasma to achieve a surface passivation in process step 1 and qualified adhesion properties in process step 2. A possible working-program could look like:
 - Development of different coating/layer-systems depending on their influence on surface passivation and adhesion properties in process step 1 and 2 (Determination of surface passivation and adhesion properties with sessile drop method and systematical interface analysis via EDX, XPS, etc.)
 - Influence of the layer thickness on surface passivation / adhesion properties
 - Transfer result to real sandwich components (Determination of mechanical properties, processing properties)
 - Derivation of optimal layer system, layer conditions, process-times, etc.



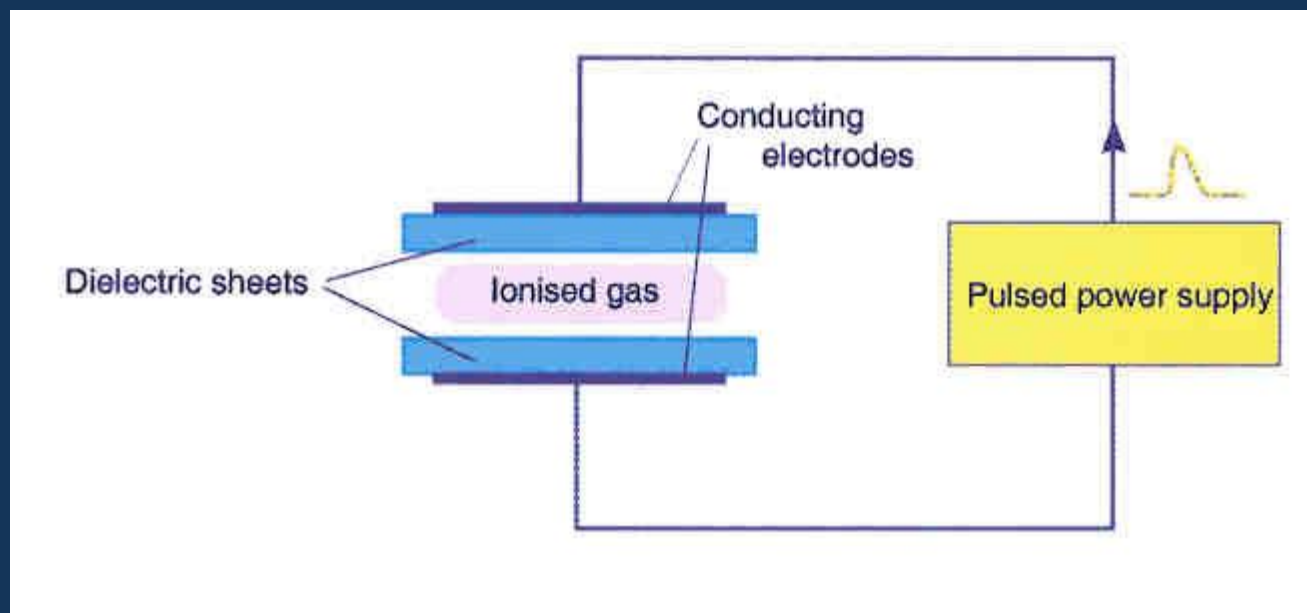
Current Concept from Univ. Clausthal

- Zinc-coated Sandwich process route consisting of (1) one sided galvanizing of steel sheets (in a conventional hot dip galvanizing process) and (2) producing the Sandwich Structure with a plastic core layer.

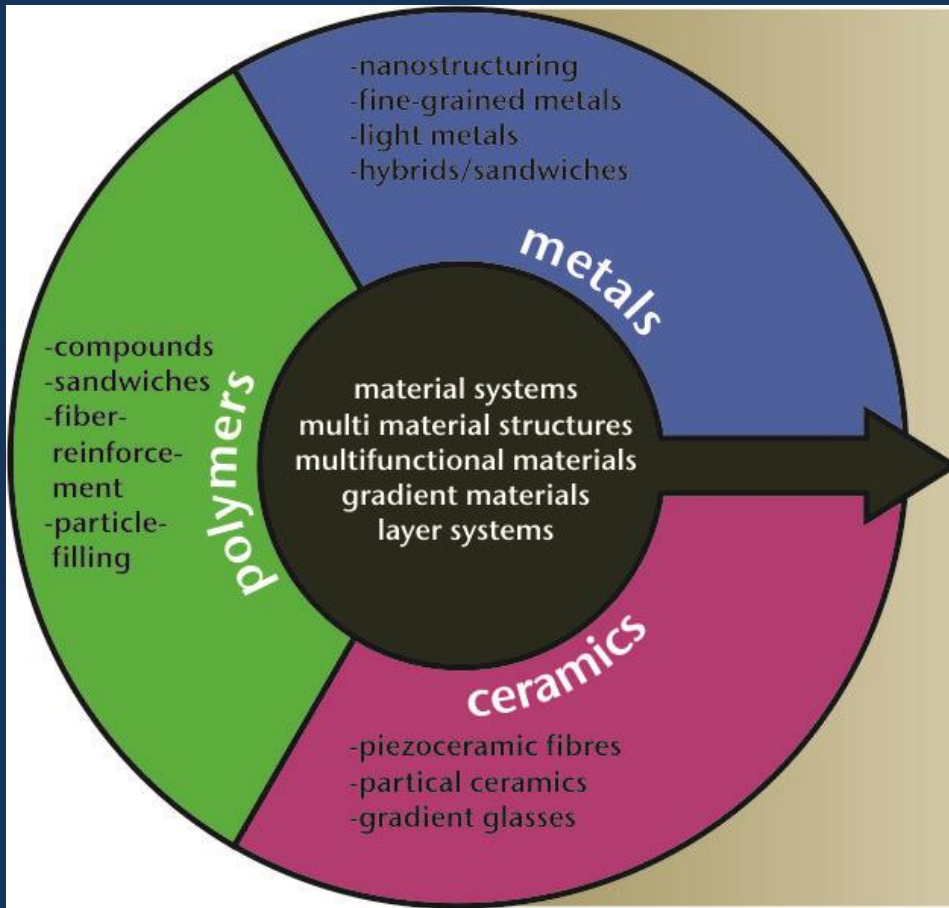
Produce one-sided surface passivation with a plasma treatment (DBD-Plasma) before the galvanising process. The modified (non zinc-coated) surface should enable good adhesion properties for the plastic core in the second process step. Testing of the wettability/bonding possibility of the modified surface in process step 1 and step 2 would be an integral part of the project. In this context, all required analysis methods are available. In Addition the processing properties (forming, welding/brazing with RP, GMAW, Laser, etc.) of a galvanized Sandwich could also be investigated.



Dielectric Barrier Discharge (DBD) Plasma



Multifunctional material systems at Univ. Clausthal

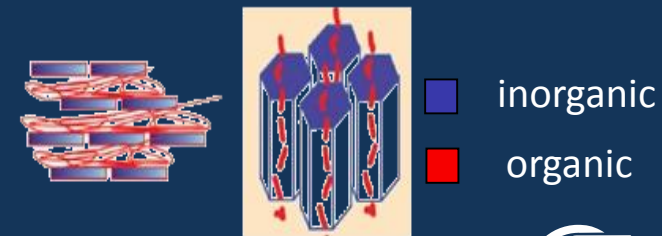
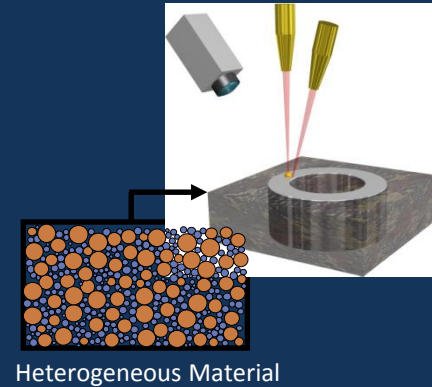


Solution matrix:

- Accomplishment of structural requirements
- Implementation of functions by material systems
- Integration of sensors / actuating elements (active structures)
- new layer systems for higher loads

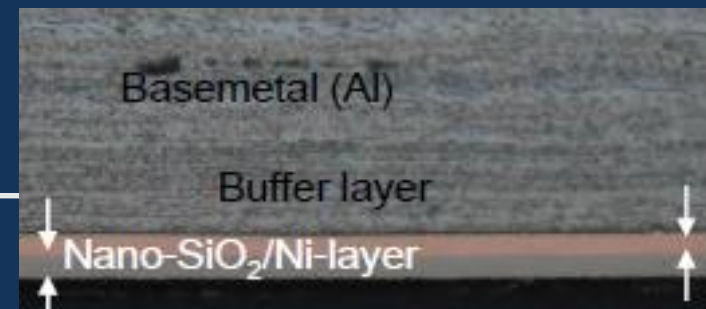
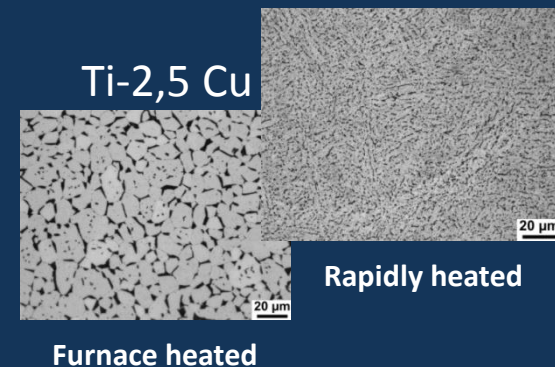
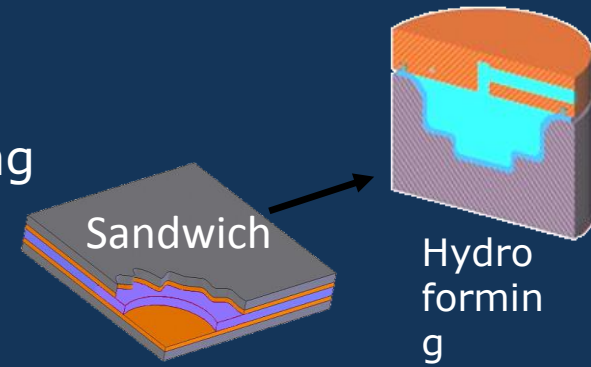
Research groups of the CZM

- RG1: Production of material combinations for adapted applications via powder metallurgical techniques
 - Material and powder development
 - Finish quality, abrasion resistance, adjusting porosity
 - Buffering layers
- RG2: Resource efficiency
 - Mechanical conditioning of scrap metal to adjust defined (surface)-properties for metal recycling
 - Detoxication of metal recycling loops
 - Separating processes for composite materials as a basis for new recycling loops
 - Prediction of the recycling behavior of aged materials
- RG3: Inorganic-organic hybrid materials, nano materials, processes and polymers for Rapid Manufacturing
 - Microheterogeneous polymer composites
 - Ultrasonic-emulsion polymerization method
 - Reactive nano particles



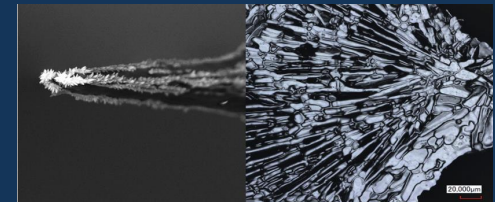
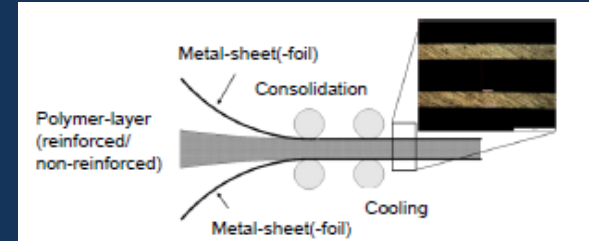
Research groups of the CZM

- RG4: Forming technology– medium based processing of mono- and hybrid materials
 - strip-, sheet-, wire- und tube processing
 - Forming operations and process sequences
 - Forming technology for material combinations
- RG5: Material systems with light metal materials
 - Alloys with enhanced properties
 - Grain-refinement and nano structuring
 - Hybrid structures
- RG6: Lifetime prediction of multi material systems
 - Geometrical optimizing of structures
 - Fatigue strength
 - Reducing of loads



Research groups of the CZM

- RG7: Producing- and processing techniques for reinforced polymers
 - Layer-wise incorporated structure elements
 - Setting properties through fiber- and filler material combinations
 - Optimized fiber surfaces
- RG8: Optimization of materials and functions through operation sequences
 - Operation sequences for multi material structures
 - corrosion-, oxidation- and wear- resistant layers
 - Virtual process sequences
- RG9: Surface fictionalization and surface analysis
 - Surface reactions, corrosion
 - Plasma-modification of surfaces



Research groups of the CZM

- RG10: High temperature processes
 - Kinetic processes und diffusion in solid state materials
 - Saving of energy, CO₂-emission reduction
 - Reducing the CO₂-load of mineral construction materials
 - Development of a fuel database of conventional and oxyfuel firing systems
- Superordinated Research group:
Modeling, identification und simulation
 - Development of material models
 - Model equations of elasticity, plasticity and viscoelasticity
 - Identification of material parameters
 - Implementing of model equations in commercial finite-element software

