

1. A Fraunhofer IFAM input to Taxonomy and/or Ontology

Michael Noeske: works at Fraunhofer IFAM since 2001 performing materials (surfaces) characterization and development, quality assurance and contributing to workforce qualification

In these main fields of his work, a set of several branches of taxonomies related to an “Adhesive Bonding Technology Taxonomy”# is implicitly applied and subsequently detailed.

Establishing a widely accepted “Adhesive Bonding Technology Ontology” is aspired, since the benefits of a “Welding Ontology” are published [Stropnik et al., Tehnički vjesnik 24, 4(2017), 1235-1242], with both welding and adhesive bonding being joining technologies based on special processes.

2. Implicit Application of Taxonomy

Branches of an “Adhesive Bonding Technology Taxonomy” are implicitly applied for:

- (1) **publishing/reporting** research findings
- (2) **patenting** material-related or process-related inventions
- (3) **training material and/or manufacturing specialists**
in vocational education training (VET)

With respect to **re-use of data in new innovations**,

- (1) scientific publishing often requires novelty (and research of state of the art)
- (2) patenting requires novelty (and description of state of the art)
- (3) VET requires a didactic-methodic selection of up-to-date key information, appropriate for the position and role of each employee in the company

3. Intended Purpose of Taxonomy

Branches of an “Adhesive Bonding Technology Taxonomy” are intended to:

- (1) provide **consistent vocabulary** to distinct specialists in the process chain
 - who act in distinct documented roles (e.g. worker, technical decider);
 - who deal with material- or manufacturing-related data (e.g. from tests, inspections, data sheets)

- (2) **represent and provide** relations/links between distinct regulations

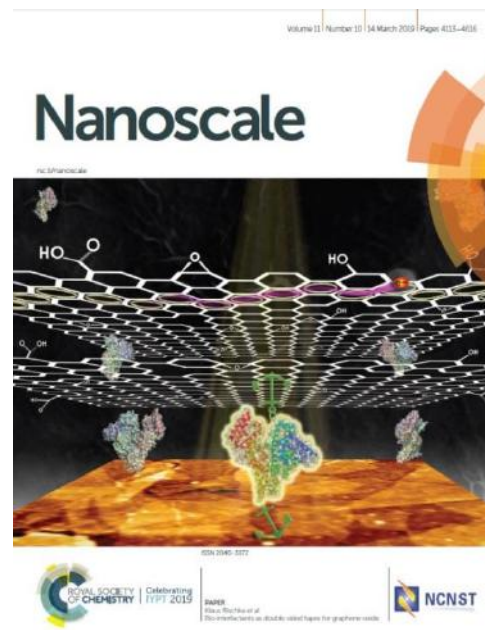
- (3) in VET, selection of distinct branches is result of a **priorisation** for a mixed audience from industrial
 - manufacturing
 - material development
 - material characterisation
 - quality assurance

4. Representation of the World

In an “Adhesive Bonding Technology Taxonomy” the world is represented predominantly as discrete particles

(resp. as discrete objects/devices following the bonding process).

For one given material, electronic, atomistic, mesoscopic or continuum views are applied, depending on the phenomenon to be assessed.



5. Concepts in the Upper Level of Taxonomy

Upper level concepts are related to materials and (their) manufacturing (processes):

- (1) agent (i.e., humans, physical, or digital components that interact
 - as operators or operands
 - using communication)Namely, human agents and their actions are targeted by VET.
- (2) communication (e.g. with the target of quality control)
- (3) control (e.g. by comparing measured actual values with set reference values, considering
 - process data (e.g. environmental)
 - material-related data)
- (4) material (e.g. its transformation as an operand during the process)

Slide no. 8 sketches an overview indicating relations exceeding *is-a* .

6. Industrial use cases of Taxonomy (or aspired Ontology)

Industrial use cases for “Adhesive Bonding Technology Taxonomy” are presently#:

(1) **advancing technical quality assurance** (e.g. by networked[§] extended non-destructive testing tools for in-process ENDT, e.g. enhancing H2020 project ComBoNDT “Quality assurance concepts for adhesive bonding of aircraft composite structures by advanced NDT”&)

(2) **training adhesive bonding specialists** (VET).

Adhesive bonding is a growing joining technology worldwide. The taxonomy allows assessing observed phenomena in a trainable way, as the base for technological communication in and between enterprises. Ontology-driven tools would help trainers to update subject matter and (more than 1000) participants (in Bremen per year) to be provided customised up-to-date information.

... Like welding, adhesive bonding it is a “Special Process” (following DIN EN ISO 9001).

It profits from technical and organisational (e.g. qualification of bonding personnel) quality assurance.

§ ... Highlighted in parallel session “B2. Innovative manufacturing and MRO”, 8th European Aeronautics Days, Bucharest, Tuesday 28 May 2019, chaired by Andreas Wiesinger (European Commission).

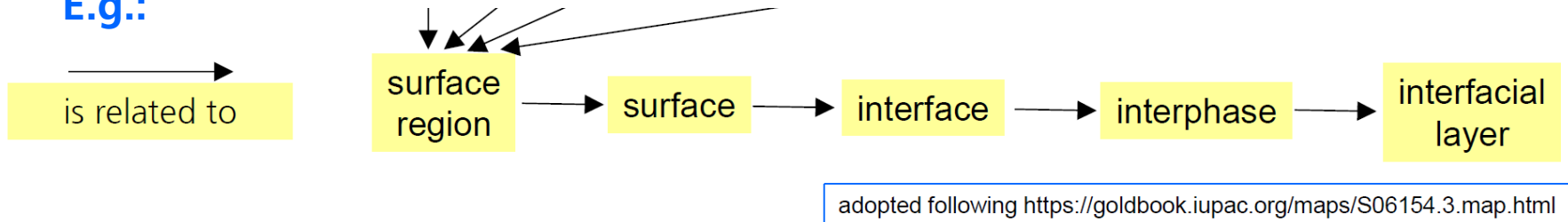
& ... The project ComBoNDT has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 636494).

7. Overlaps with other Taxonomy and/or Ontology

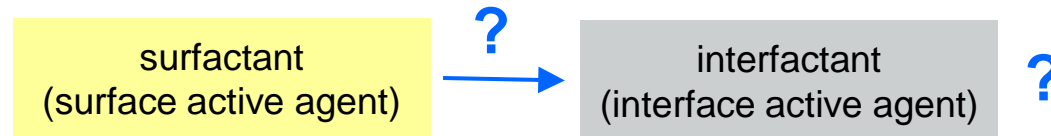
Overlap of an “Adhesive Bonding Technology Taxonomy/Ontology” with:

- DIN EN 923
- ISO 9001
- IUPAC (International Union of Pure and Applied Chemistry) goldbook with respect to chemical material and interaction aspects

E.g.:



Thus, would a molecular agent which is active at a solid-solid interface be a



Check for updates

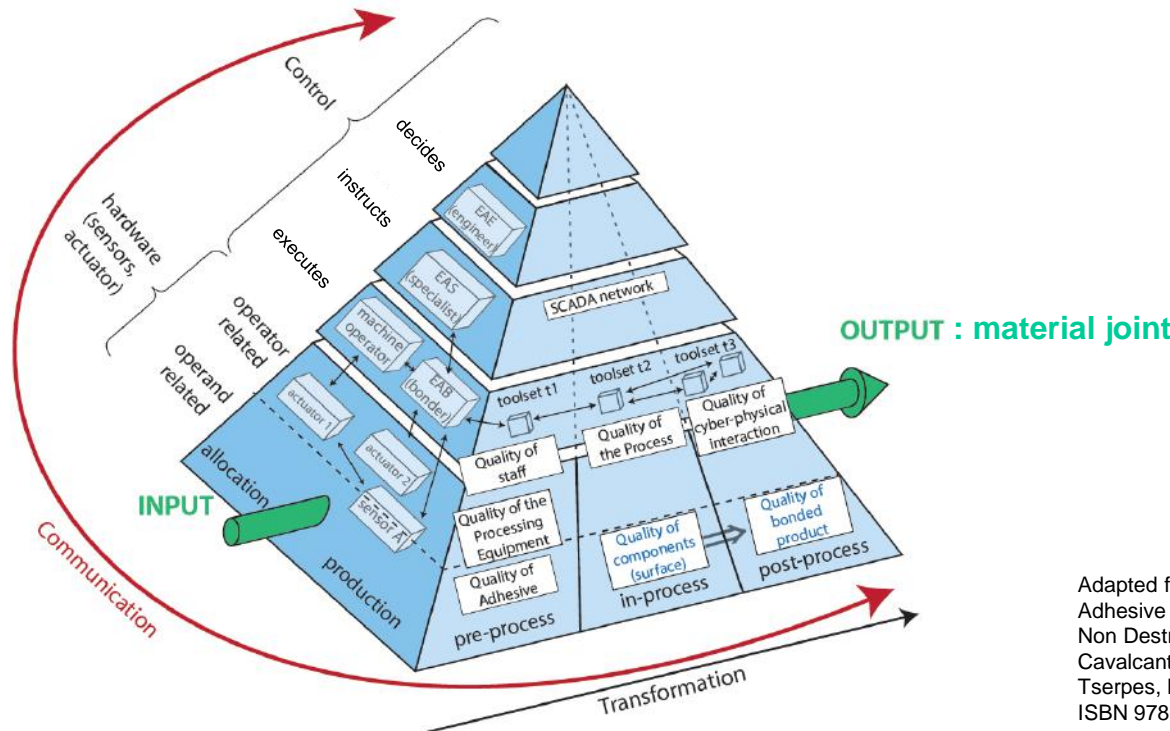
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Bio-interfactants as double-sided tapes for graphene oxide[†]

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8. Progress in Automation based on an aspired Ontology

An “Adhesive Bonding Technology Ontology” profiting from EMMO shall be aspired to the support multi-dimensional perception of this interdisciplinary cross-sectional technology. Starting from a workshop-based coordinate system, the “adhesive bonding process pyramid” highlights quality-relevant aspects:



SCADA:	Supervisory Control and Data Acquisition
EAE:	DVS®-EWF- European Adhesive Engineer
EAS:	DVS®-EWF- European Adhesive Specialist
EAB:	DVS®-EWF- European Adhesive Bonder

Adapted from:
 Adhesive Bonding of Aircraft Composite Structures
 Non Destructive Testing and Quality Assurance Concepts
 Cavalcanti, W.L., Brune, K., Noeske, M.,
 Tserpes, K., Ostachowicz, W., Schlag, M. (Eds.)
 ISBN 978-3-319-92809-8, Springer International Publishing, 2019.