

Certificate Course Smart Materials

Detailed Program



Certificate Course
Smart Materials
March – June 2021



Modul 1

04./05.03.2021
18./19.03.2021

Modul 2

08./09.04.2021
22./23.04.2021

Modul 3

06./07.05.2021
20./21.05.2021

Modul 4

10./11.06.2021
17./18.06.2021

Industrial Speakers / Teachers

G. Hiebler, **GPS Villach**
Dipl. Ing. H. Lammer, **Wood K Plus**
Dr. L. Hensgen, **Tribotecc**
Dr. M. Schmied, **iDIATEC Consult**
R. Pufitsch, **Silent Quo**
Dr. A. Czechowicz, **HOFFMANN Kunststoffe**
Dipl.-Ing. G. Clément, **HARATECH**
Ing. M. Haiberger, CEO, **HARATECH**

Academic Speakers / Teachers

FH-Prof. DI Dr. habil. P. Nicolay, **CUAS**
FH-Prof. DI Dr. F. Riemelmoser, **MBA, CUAS**
FH-Prof. DI Dr. techn. R. Willmann, **CUAS**
Dipl.-Päd. P. Amann, **BSc., CUAS/Smart Labs**
C. Becker, **MSc., UTC Compiègne**
S. Thaler, **BSc, MSc., CUAS**
H. Oberlercher, **MSc., CUAS**
A. Berndt, **MSc., CUAS**
M. Laux, **MSc., CUAS**
Dipl.-Ing. H. Kunze, **Fraunhofer IWU**
Dr. B. Assouar, **University of Lorraine, IJL**
D. Zettel, **MSc., CUAS**

Module 1 – Materials and Additive Manufacturing, Basics (24H – 2ECTS)

04.03.2021 – Materials, Back-to-Basics

09:00 – 11:00	Ceramics	H. Ragossnig	online	de
11:15 – 12:15	Polymers & Metals	P. Nicolay	online	en/de
13:45 – 16:45	Materials selection	F. Riemelmoser	online	de

05.03.2021 – Introduction to Additive Manufacturing techniques

09:00 – 12:15	Polymers, Metals and <u>Ceramics</u>	H. Ragossnig	online	de
13:45 – 14:45	Polymers, Metals and <u>Ceramics</u>	H. Ragossnig	online	de
15:00 – 17:00	When, where and why 3D Printing?	R. Willmann	online	de

18.03.2021 – Practical Work

09:00 – 17:00	Polymer 3D Printing	P. Amann	FH Smart Labs Klagenfurt	de
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19.03.2021 – Practical Work

09:00 – 17:00	Metal 3D Printing	G. Hiebler	GPS Villach	de
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Modul 2 - High-performance materials (24H – 2ECTS)

08.04.2021 – High-performance fiber-reinforced composite materials

09:00 – 12:15	Composite materials	H. Lammer	Seminar Raum 12, FH Villach	de
13:30 – 15:30	FDM 3D Printing of composite materials	C. Becker (online)	Seminar Raum 12, FH Villach	de
15:45 – 16:45	FDM 3D Printing of composite materials, Two application examples ¹	H. Oberlercher	Seminar Raum 12, FH Villach	de

09.04.2021 – Innovation-enabling high-performance materials

09:00 – 13:15	Advanced coatings for high-end industrial applications	L. Hensgen M. Schmied	Seminar Raum 12, FH Villach	de
14:30 – 15:30	Advanced materials for acoustic isolation	R. Pufitsch	Seminar Raum 12, FH Villach	de
15:45 – 16:45	Phase-changing materials for energy storage applications	S. Thaler	Seminar Raum 12, FH Villach	de

22.04.2021 – Practical work (Part 1)²

09:00 – 17:00	3D-Printing and Mechanical Characterization of Lightweight CFRP parts	A. Berndt & M. Laux	Seminar Raum 8, Smart Lab Carinthia, Villach	de
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23.04.2021 – Practical work (Part 2)²

09:00 – 17:00	3D-Printing and Mechanical Characterization of Lightweight CFRP parts	A. Berndt & M. Laux	Seminar Raum 8, Smart Lab Carinthia, Villach	de
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¹ The two examples will be designed, 3D-printed and mechanically characterized in Module 2, BLOCK 2 (i.e. Practical work)

² Students are divided in two groups, for better supervision

Modul 3 - Smart Materials (24H – 2ECTS)

06.05.2021 – Shape-Memory Materials

09:00 – 11:00	Shape-memory & super-elastic metals, Sensor applications	H. Kunze (online)	Innovations Werkstatt 10, Campus Villach	de
11:15 – 13:15	Shape-memory and super-elastic metals, Industrial applications	A. Czechowicz (online)	Innovations Werkstatt 10, Campus Villach	de
14:45 – 17:00	Shape-memory polymers & Non-Newtonian fluids (Part 1)	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de

07.05.2021 – Smart & highly textured materials

09:00 – 17:00	Non-Newtonian fluids (Part 2, incl. Ferrofluids, Magneto-rheological fluids, Thixotropic and Dilatant Fluids), Self-healing/Self-sealing materials, Thermo-, photo- and piezo-chromic polymers, Polymer/Ceramic/Metallic foams, Aerogels, Super-hydrophobic materials	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de
	Description of Practical Work (Goals, Expectations...), BeCreative! ³	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de

20.05.2021 – Meta Materials; “Functional & smart” materials (Part 1)

09:00 – 12:15	Mechanical, Electromagnetic and <u>Acoustic</u> Meta-Materials.	B. Assouar (online)	Seminar Raum 12, FH Villach	en
13:45 – 16:45	Functional & smart” materials (Part 1): Piezoelectric materials and applications (incl. SAW & BAW Filters, SAW & BAW Sensors, piezo-based energy-harvesting solutions, smart-made materials with integrated piezo-sensors, USED Technology)	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de

21.05.2021 – „Functional & smart” materials (Part 2); Practical work

09:00 – 11:00	„Functional & smart” materials (Part 2): Magnetostrictive materials, graphene and carbon nano-tubes	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de
11:00 – 12:15	Practical work (“BeCreative”, final presentations) (Part 1)	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de
13:45 – 16:45	Practical work (“BeCreative”, final presentations) (Part 2)	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de

³Students identify one technical problem and elaborate a solution based on one or a combination of Smart Materials (incl. presentation)

Modul 4 – Smart Products & 4D-Printing (24H – 2ECTS)

10.06.2021

09:00 – 10:00	3D-printed Hybrid Structures, 3D-printed Smart Materials (incl. Shape Memory Materials, Meta-Materials)	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de
10:00 – 13:00	From 3D to 4D printing (state-of-the-art, working principles, current limitations and perspectives), self-folding, self-deploying & self-assembling structures, soft-robots, adaptive structures, smart-made structures with {3D-printed} embedded conductive filaments, sensors (incl. capacitive), actuators & modules (incl. PV modules and flexible electronics), magnetic shape-shifters, wearable flexible sensors	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de
14:30 – 16:45	Smart Concrete & Integrated Surface Acoustic Wave RFID Sensors	P. Nicolay	Innovations Werkstatt 10, Campus Villach	en/de

11.06.2021

09:00 – 11:00	Smart Wood	H. Lammer	Innovations Werkstatt 10, Campus Villach	de
11:15 – 12:45	3D-Printing for Medical Applications	G. Clément	Innovations Werkstatt 10, Campus Villach	en/de
14:15 – 16:45	Smart Textiles	M. Haiberger	Innovations Werkstatt 10, Campus Villach	de

17.06.2021 – Practical Work

09:00 – 12:00	Generative Design ⁴ and beyond	D. Zettel	3.16 c, Campus Villach	de
13:30 – 16:30	Multiphysics simulation ⁵ of Smart Materials & Products	P. Nicolay	3.16 c, Campus Villach	en/de

18.06.2021 – Final Day

09:00 – 10:00	<u>Free slot</u> (external talk, TBD by Students and Teachers)	P. Nicolay	3.16 c, Campus Villach	en/de
10:15 – 12:15	<u>Practical Work</u> : Analysis and test of two different CiSMAT 3D/4D-Printed Demonstrators	P. Amann & A. Berndt	3.16 c, Campus Villach	de
13:45 – 17:00	<u>Practical Work</u> : Exposés on one 3D/4D Printing topic of particular interest	P. Nicolay	3.16 c, Campus Villach	de

⁴AutoDesk FUSION, ParaMatters

⁵COMSOL Multiphysics, e.g. simulation of a MRF Braker