Twinning to excel materials engineering for medical devices

- **AALTO University Foundation**
- **School of Chemical Engineering, Department of Chemical and Metallurgical Engineering (CMET), Materials Processing Lab**
- **Head:** Prof. Dr. Michael Gasik, Dr. Sci., EORS Ambassador
- **Participants/staff**: M.Sc. Alexandra Zühlke (Dept. CMET), Dr. Katarina Dimic-Misic (Dept. BIO2)
- **Research topics**: biomaterials development and evaluation for dental, orthopedic and tissue engineering applications
- **Research expertise**: over 25 years in biomaterials research. Several EU and national projects. EORS and TERMIS activities.
- **Contact: michael.gasik@aalto.fi**

Acronym: AALTO
Aalto University Foundation
P.O.Box 16100
FIN-00076 AALTO, Espoo

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Experience in biomaterials

- Metallic alloys (Ti Gr.2, Ti Gr.5, TiNbZr(Si), TiGa, TiAlZrSi(Ga), NbZr(PtPd), CoCrMo…) and coatings (VPS Ti, EPD Ti, …)
- Bioceramics and ceramic coatings (HAP, TCP, TiO_2, Al_2O_3, ZrO_2, $BaTiO_3$…); aligned ceramic nanofibers (GAIN)
- Hydrogels (NaHA, PVA, Gelatine, composite etc.)
- Polymers (PLA, PE, PVA,…)
- Biologicals (collagen, natural products, cellulose derivatives)
- Tissue phantoms (bone, skin, …)
- Cell-laden materials (hydrogels)
- Ex-vivo (perinatal derivatives)

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Experience in Applications

- Orthopaedic and orthobiology (*bone, articular joints*)
- Dental (*restorative / regenerative; hard and soft tissues*)
- Soft tissue augmentation
- Wound healing, immune reactions
- Antibacterial solutions (*biofilm prevention and control*)
- Injectables (i*ndirectly: also for 3D bioprinting)*
- For *in vitro* applications (*scaffolds for cells and virions research*)
- Perinatal derivatives and their applications
- Particles release analysis
- MedTech solutions promotion (*with Health Incubator Helsinki, Aalto Health Platform, local and international organizations*)

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Facilities

- Thermal analysis (DSC+TGA+FTIR, DIL, TPS)
- Biomechanical analysis (DMA)
- Particle size analysis (PCS, LDA)
- Spectrometry (Raman, FTIR, etc.)
- Rheometry
- Nanoindentation
- Optical and electron microscopy
- Specimens preparation; clean rooms
- Special BIO infrastructure access - *from other departments can be made available*

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Selected project references

- MSCA ITN-ETN:LIF “Precision medicine for muscolo-skeletal regeneration, prosthetics and active ageing” (PREMUROSA), EU H2020, 2020-2023
- COST CA17116 “International Network for Translating Research on Perinatal Derivatives into Therapeutic Approaches” (SPRINT), 2018-2022
- "Personalised and/or generalised integrated biomaterial risk assessment” (PANbioRA), EU H2020 project, 2018-2022
- "New materials for virology diagnostics and applications” (ViroGAIN), 2016-2017
- COST MP1301 "New generation biomimetic and customized implants for bone engineering" (NEWGEN), 2015-2017
- “Graphene-augmented nano-fibrous scaffolds” (ULTRINIA), 2014-2016
- COST MP1005 "From Nano to Macro Biomaterials (design, processing, characterization, modelling) and applications to stem cells regenerative orthopaedic and dental medicine" (NAMABIO), 2013-2015
- "Development of the Pt- and Pd-alloyed biomedical Zr-Nb alloys", Finnish-Japanese project, 2010-2012
- “Multifunctional bioresorbable biocompatible coatings with biofilm inhibition and optimal implant fixation” (MEDDELCOAT), EU SME-IP, 2006-2011
- “Increasing the performance of total hip replacement prostheses through functionally graded materials innovation and design” (BIOGRAD), EU project, 2001-2005

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