

Research Group

Advanced materials Laboratory - ADMALAB

Reference year:

2024

Scientific Coordinator:

AVERSA RAFFAELLA / Associate Professor / Department of Architecture and Industrial Design (DADI) / University of Campania "Luigi Vanvitelli"

Group members:

APICELLA Antonio/Full Professor/DADI/ University of Campania "Luigi Vanvitelli" retired on the 31/10/2022

IANNACE Gino / Associate Professor / DADI / University of Campania "Luigi Vanvitelli"

FEMIANO Felice / Associate Professor / Multidisciplinary Department of Medical-Surgical and Dental Specialties /

RICCIOTTI Laura/ Assistant professor/ DADI/ University of Campania "Luigi Vanvitelli"

PERROTTA Valeria / Research fellow / DADI / University of Campania "Luigi Vanvitelli"

Prof. CHAO Wang / Beihang University/Chongqing Medical University, China

Prof. GUIXUE Wang / Chongqing University, Biomechanical School, China

Prof. PETRESCU Fabian / University of Bucharest, Engineering School, Romania

Prof. PLESKOVA Svetlana / Research and Education Center for Physics of Solid State Nano-Structures, Lobachevsky State University of Nizhny Novgorod Russia

Description of research lines:

The working group that operates in the laboratory is made up of teachers, contractors, research fellows and PhD students who are interested in the development and characterization of advanced materials (biomaterials, nanomaterials, glassy metals, surface treatments, shape memory alloys), technology transfer from advanced biomedical and aerospace sectors for Industrial Design and Sustainable Product Design and Production products.

The laboratory is currently involved in research activities on:

- biomechanics and biomimetics;
- development of new low-invasive prosthetic systems with trabecular metal structure sintered;
- application of additive technologies (3D printing) of metal components;
- design of biomimetic metal trabecular structures;
- scaffolds for tissue engineering;
- mechanical and calorimetric characterization of polymeric and composite materials; - processing techniques for polymeric and composite materials;
- smart materials based on Shape Memory Alloy.
- Geopolymers and ceramics

Relationships with other research groups of the University of Campania L. Vanvitelli during the last three years:

Research activity in progress with prof. Felice Femiano of the Multidisciplinary Department of Medical-Surgical and Dental Specialties. Evaluation of physical and chemical surface treatments on dental enamel with electron microscopy and atomic force microscopy investigations, differential calorimetry and mechanical characterization.

Participation in research projects during the last three years:

GEA: Geopolymers for Environmentally-friendly Architecture: A Chemo-rheology and Thermo-kinetic investigation for the development of 3D Printable formulations.

PI: Dott.ssa Laura Ricciotti

BioSafety

PI: Prof. Raffaella Aversa

Call: INAIL, BRIC 2022

BIOSAFE

PI: Prof. Raffaella Aversa

Call: MAECI, Cooperation research Italy-China

IR and visible light-activated antimicrobial properties and biosafety of new self-sterilizing non-stoichiometric metal oxides/polymer hybrid hydrogels for tissue engineering

PI: Prof. Raffaella Aversa

Call: MIUR - PRIN 2022

BIOPRINTING

PI: prof. Antonio Apicella

Electron beam manufactured biomimetic scaffold

Call MIUR, 2020

New photoactive metal-oxides/polymer hybrid nanocomposites for visible light Localized Surface Plasmon Resonance (LSPR) self-sterilizing medical devices

Call: Russia-Italy Scientific Cooperation, Russian funds

PI: prof. Antonio Apicella

Scientific products during the last three years:

10 scientific publications in Class A journals and/or indexed in the Scopus/WoS databases:

[1] Ricciotti, L., Apicella, A., Perrotta, V., Aversa, R. Geopolymer Materials for Extrusion-Based 3D-Printing: A Review (2023) *Polymers*, 15 (24), art. no. 4688,

Meng, X., Wang, C., Xu, W., Wang, R., Zheng, L., Wang, C., Aversa, R., Fan, Y.

Effects of different designs of orthodontic clear aligners on the maxillary central incisors in the tooth extraction cases: a biomechanical study (2023) *BMC Oral Health*, 23 (1), art. no. 416, . Cited 1 time.

[2] Aversa, R., Perrotta, V., Wang, C., Apicella, A. Bio-Resorption Control of Magnesium Alloy

AZ31 Coated with High and Low Molecular Weight Polyethylene Oxide (PEO) Hydrogels (2023) *Gels*, 9 (10), art. no. 779, Aversa, R., Ricciotti, L., Perrotta, V., Apicella, A. Chemorheology of a Si/Al₂O₃ Alkali Activated Metakaolin Paste through Parallel Differential Scanning Calorimetry (DSC) and Dynamic Mechanical Analysis (DMA) (2023) *Polymers*, 15 (19), art. no. 3922, . Cited 1 time.

[3] Zheng, L., Chen, D., Wang, C., Ai, L., Li, Y., Hu, M., Aversa, R., Wang, L., Fan, Y. Comparative evaluation of personalized 3D-printed scaffold-driven double-barrel fibula flap for the reconstruction of segmented mandibular defects (2023) *Materials and Design*, 234, art. no. 112310,

[4] Aversa, R., Franchino, R., Frettoloso, C., Pisacane, N., Ricciotti, L.

GEOPOLYMERS FOR ECO-ARCHITECTURE Integrated approaches for green strategies activation (2023) *Agathon*, 13, pp. 237-246. Cited 1 time.

[5] Ricciotti, L., Apicella, A., Perrotta, V., Aversa, R. Geopolymer Materials for Bone Tissue Applications: Recent Advances and Future Perspectives (2023) *Polymers*, 15 (5), art. no. 1087, Cited 7 times. Yang, W, Chen, D., WANG CHAO, Apicella, A., The effect of bone defect size on the 3D accuracy of alveolar bone augmentation performed with additively manufactured patient-oriented titanium meshes. (2022) *BMC Oral Health*, 22(1), art.no.557

[6] Femiano, F., Femiano, R., Femiano, L., Nucci, L., Santaniello, M., Grassia, V., Scotti, N., Aversa, R., Perrotta, V., Apicella, A., Apicella, D. Enamel Erosion Reduction through Coupled Sodium Fluoride and Laser Treatments before Exposition in an Acid Environment: An In Vitro Randomized Control SEM Morphometric Analysis (2022) *Applied Sciences (Switzerland)*, 12 (3), art. no. 1495 DOI: 10.3390/app12031495

[7] Wang, L., Aversa, R., Houa, Z., Tian, J., Liang, S., Ge, S., Chen, Y., Perrotta, V., Apicella, A., Apicella, D., Cioffi, L., Wang, G Bioresorption control and biological response of magnesium alloy az31 coated with poly-β-hydroxybutyrate (2021) *Applied Sciences (Switzerland)*, 11 (12), art. no. 5627

[8] Aversa, R., Petrescu, R.V., Petrescu, F.I.T., Perrotta, V., Apicella, D., Apicella, A. Biomechanically tunable nano-silica/p-hema structural hydrogels for bone scaffolding, (2021) *Bioengineering*, 8 (4), art. no. 45, .

[9] Petrescu, R.V.V., Aversa, R., Perrotta, V., Ungureanu, L.M., Apicella, A., Petrescu, F.I.T. News in bone modeling for customized hybrid biological prostheses development, (2021) *Online Journal of Biological Sciences*, 21 (2), pp. 285-316.

[10] Aversa, R., Petrescu, R.V.V.; Apicella, A.; Petrescu, F.I.T., About Biological Hip Joint Prostheses And The Biomechanical Behavior Of Implanted Femur, *Independent Journal Of Management & Production* Volume 12 Issue 8 Page 2017-2044 DOI 10.14807/ijmp.v12i8.958

Additional 10 scientific products:

[1] Ricciotti, L., Apicella, A., Perrotta, V., Aversa, R. Geopolymer Materials for Extrusion-Based 3D-Printing: A Review (2023) *Polymers*, 15 (24), art. no. 4688

[2] Meng, X., Wang, C., Xu, W., Wang, R., Zheng, L., Wang, C., Aversa, R., Fan, Y. Effects of different designs of orthodontic clear aligners on the maxillary central incisors in the tooth extraction cases: a biomechanical study (2023) *BMC Oral Health*, 23 (1), art. no. 416, . Cited 1 time.

[3] Aversa, R., Perrotta, V., Wang, C., Apicella, A. Bio-Resorption Control of Magnesium Alloy AZ31 Coated with High and Low Molecular Weight Polyethylene Oxide (PEO) Hydrogels (2023) *Gels*, 9 (10), art. no. 779

[4] Aversa, R., Ricciotti, L., Perrotta, V., Apicella, A. Chemorheology of a Si/Al₂O₃ Alkali

Activated Metakaolin Paste through Parallel Differential Scanning Calorimetry (DSC) and Dynamic Mechanical Analysis (DMA) (2023) *Polymers*, 15 (19), art. no. 3922, . Cited 1 time.
 [5] Zheng, L., Chen, D., Wang, C., Ai, L., Li, Y., Hu, M., Aversa, R., Wang, L., Fan, Y. Comparative evaluation of personalized 3D-printed scaffold-driven double-barrel fibula flap for the reconstruction of segmented mandibular defects (2023) *Materials and Design*, 234, art. no. 112310,
 [6] Aversa, R., Franchino, R., Frettoloso, C., Pisacane, N., Ricciotti, L. GEOPOLYMERS FOR ECO-ARCHITECTURE Integrated approaches for green strategies activation (2023) *Agathon*, 13, pp. 237-246. Cited 1 time.
 [7] Ricciotti, L., Apicella, A., Perrotta, V., Aversa, R. Geopolymer Materials for Bone Tissue Applications: Recent Advances and Future Perspectives (2023) *Polymers*, 15 (5), art. no. 1087, Cited 7 times.
 [8] Wang, L., Aversa, R., Houa, Z., Tian, J., Liang, S., Ge, S., Chen, Y., Perrotta, V., Apicella, A., Apicella, D., Cioffi, L., Wang, G. Bioresorption control and biological response of magnesium alloy az31 coated with poly- β -hydroxybutyrate (2021) *Applied Sciences (Switzerland)*, 11 (12), art. no. 5627
 [9] Aversa, R., Petrescu, R.V., Petrescu, F.I.T., Perrotta, V., Apicella, D., Apicella, A. Biomechanically tunable nano-silica/p-hema structural hydrogels for bone scaffolding (2021) *Bioengineering*, 8 (4), art. no. 45, . Cited 3 times. 10.3390/bioengineering8040045
 [10] Petrescu, R.V.V., Aversa, R., Perrotta, V., Ungureanu, L.M., Apicella, A., Petrescu, F.I.T. News in bone modeling for customized hybrid biological prostheses development(2021) *OnLine Journal of Biological Sciences*, 21 (2), pp. 285-316. DOI: 10.3844/ojbsci.2021.285.316

Relationships with international and national Companies, Institutions, Research Centers, Universities during the last three years:

- Adler Ortho, Cormano Milan - Research and collaboration agreements on 3D printing
- East China University of Science and Technology, Shanghai China (framework agreement proposed by Prof Apicella and Prof Chen and signed by the two Rectors)
- Chongqing University, collaboration agreement
- Sant'Anna University of Pisa.
- Beihang University, Beijing, School of Biological Science and Medical Engineering, China

Collaborations with Consortia, Scarl or other Institutions participated by the University of Campania L. Vanvitelli during the last three years:

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ISI Web of Science Subject Categories:

- Engineering, Biomedical
- Polymer Science
- Materials Science, Biomaterials
- Materials Science, Characterization & Testing
- Materials Science, Composites
- Materials Science, Multidisciplinary
- Materials Science, Ceramics

Scientific-Disciplinary Sectors:

- ING-IND/22
- ING-IND/11
- MED-28

Keywords:

- Biomechanics
- Biomimetics
- New biocompatible materials
- Scaffolds
- Additive technologies
- Geopolymers and ceramics
- Metamaterials
- Acoustic Materials characterization

ERC Categories:

- PE5-7
- PE8-8
- PE8-9
- PE11-1,2,3,4,5,10,11
- SH4-5