



PhD in Materials Engineering

Research Area: Biomaterials

Title: Additive manufacturing of zirconia and nanostructured alumina/zirconia dental prosthesis

Synthetic dental materials are used to repair/replace missing tooth tissue, allowing to reestablish masticatory, phonetic and aesthetic functions. Among them, ceramics play an important role, since they are highly compatible with oral environment, present good chemical and mechanical resistance and suitable optical properties to mimic the natural teeth. Although subtractive manufacturing (SM) technologies are commonly used to obtain the core pieces by removing surplus material from ceramic blocs in milling units, a new type of technologies based on additive manufacturing (AM), also referred to as 3D printing, is emerging as a tool with great potential to build up long term dental structures and is expected to offer several advantages over conventional manufacturing methods. Robocasting, one of the methods that can be used to obtain green pieces, involves the extrusion and layer-by-layer deposition of a ceramic paste following a digital 3D model. However, several challenges emerge when considering this technique to produce permanent ceramic dental devices. The main goal of the work is to evaluate the applicability of an AM technology (*robocasting*) to produce reliable ceramic dental structures made of zirconia and of novel alumina nanozirconia-reinforced composites able to match the severe mechanical, chemical and thermal oral requirements.


The work will be carried out at Instituto Universitário Egas Moniz (CiiEM), Instituto Superior Técnico (CQE) and Instituto Politécnico de Setúbal (IPS).

Keywords: additive manufacturing, dental prosthesis, ceramic materials, zirconia/ alumina

Publications

<https://doi.org/10.1016/j.dental.2020.01.006>

<https://doi.org/10.1080/00032719.2019.1668946>



<https://doi.org/10.1016/j.jmbbm.2018.12.009>

<https://doi.org/10.1007/s11249-019-1204-5>

<https://doi.org/10.1016/j.jmbbm.2018.08.029>

Supervisors: Professora Doutora Ana Paula Serro (Supervisor), Professor Doutor Célio Pina (IPS Co-supervisor), Professor Doutor Rogério Colaço (IST Co-supervisor).

Start Year: 2018

