

PhD Position

DEVELOPMENT OF ZEOLITE/POLYMER COMPOSITES FOR 3D PRINTING

Key-words : composite, zeolite, photopolymerization, LED, filler, 3D printing

Thesis detailed overview :

Composites are widely used in the field of polymers in order to obtain in particular reinforced mechanical properties. For example, in the dental field, they consist of a mixture of various synthetic resins (methacrylate) and 70 to 85% of a filler (quartz, glass, ceramics).

They are mainly prepared by thermal process but energy consumption and preparation times are very high. To remedy these important barriers, the use of photopolymerization is highly beneficial. Polymerization of the resin, which leads to its hardening, can be induced by the light of the light-emitting diodes (LEDs) in the presence of a photosensitive agent able to absorb the light energy in the field of visible light (e.g. blue) [1].

However, the characteristics of the filler (type, concentration, composition, particle size, etc.) have a very important influence on the penetration of light and thus on the depth of polymerization [2]. This feature and the mechanical properties of the resulting composite are key factors for 3D printing.

The search for new adapted fillers is a challenge that will lead to the development of new applications in various fields as robotics, industrial tools, healthcare, etc.

This study allows a multidisciplinary approach which consists in studying the impact of zeolitic fillers on photopolymerization, on the properties of the resulting composite especially after 3D printing. Visible light will be preferred to implement a process without harmfulness (without UV).

Profile and skills required :

- Knowledge of (or motivation to learn) porous materials and/or polymers
- You have a degree from an engineering school or a two-year university master's degree in Chemistry or Materials Science
- Strong written and oral communication skills.
- Motivation to carry out fundamental research with a strong application potential.

Duration : 3 years, starting at the end of 2020

Salary : net salary of about 1400€ per month

Supervision : Prof. Angélique Simon-Masseron (angelique.simon-masseron@uha.fr), Prof. Jacques Lalevée (jacques.lalevee@uha.fr)

To apply : please send CV detailing your training, as well as previous research experience (internships), and motivation letter to the contacts above

References :

- [1] P. Garra, C. Dietlin, F. Morlet-Savary, F. Dumur, D. Giges, J.-P. Fouassier and J. Lalevée, revue: *Photopolymerization processes of thick films and in shadow areas: a review for the access to composites*, **Polym. Chem.** **8**, 7088-7101 (2017)
- [2] Y. Xu, C. Jambou, K. Sun, J. Lalevée, A. Simon-Masseron and P. Xiao, *Effect of Zeolite Fillers on the Photopolymerization Kinetics for Photocomposites and Lithography*, **ACS Appl. Polym. Mater.** **1**, 2854-2861 (2019)