

Laboratoire MATEIS
UMR CNRS 5510



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3 years fully funded Ph.D. Thesis at MATEIS, INSA-Lyon, France

Induction Stimulated Healing of Rubber-like Materials

The project POMMADE (POLyMer Materials inDUCTION hEaling) consists in studying and developing composite materials based on auto-associative polymers and ferromagnetic particles in order to enhance the development of healable materials in the industry. Three laboratories are involved in this project: MATEIS (coordinator), LGEF (electromagnetism and instrumentation) and IMP (polymers synthesis, particles functionalization).

Scientific Project:

While self-healing materials have attracted the interest of many researchers for the last decade, their development at an industrial scale is still hindered by several factors. As a matter of fact, the mechanical properties of such “living” systems are most of the time antagonistic to their ability to self-heal, limiting in consequence their spread in major industrial sectors such as automotive and energy. In particular, reaching an elastic modulus of ca. 50 MPa or resisting to cyclic impacts still remains a tricky challenge for most of these “supramolecular polymers”, being in addition, strongly temperature dependent and often based on complex/costly synthesis routes.

In this project, we propose to use these materials in a different context, allowing to combine high mechanical performances with the ability to heal quickly and efficiently through the use of different stimulus. To do so, we propose to take advantage of the structural thermo-reversibility of thermoplastic elastomers (semi-crystalline solid / viscous liquid) by coupling them with responsive fillers, resulting into active composites when submitted to an electromagnetic field.

Fundamental aspects of the “heating by induction” will also be treated because of the great interest it presents in other scientific domains such as in medical engineering where *hyperthermia* is growingly used for curing cancer.

Although all the experimental facilities are available in our laboratory in Lyon (MATEIS), the successful candidate will have the opportunity to travel to other laboratories via international collaborations and possible stays on large instruments. He may also have the opportunity to teach at INSA (French *Grande Ecole*).

The recruitment must be done as soon as possible. The beginning of the thesis is planned for January 2019.

A post-doc researcher will be hired on the same topic in 2020.

Location: Lyon, 15 minutes from the city center.

Duration: 3 years

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Key words: Induction, Hyperthermia, Composites, Supramolecular network, Thermoplastic-elastomers

Required skills: Interest for materials science. Strong background in physico-chemistry or physics.