



## **PhD Position proposal**

<b>Job title</b>	Elaboration of functional regenerators with very high loaded MagnetoCaloric (MC) powders by different polymer processing and metallurgy processes
<b>Ref</b>	Completed by UBFC
<b>Job type (PhD, Post-doc, Engineer)</b>	Ph.D.
<b>Contract duration (months)</b>	36 months
<b>Qualifications (Master degree, PhD...)</b>	Master degree
<b>Job hours (full time/ part time)</b>	Full time
<b>Employer</b>	UBFC – Université de Franche-Comté – Besançon
<b>Host Laboratory</b>	Institut FEMTO-ST
<b>URL Host Laboratory</b>	<a href="http://www.femto-st.fr">www.femto-st.fr</a>
<b>Address Host Laboratory</b>	15b avenue des Montboucons, 25030 Besançon, France
<b>Job description</b>	<p><u>Introduction</u> :</p> <p>Magnetic refrigeration and heat pumping is a new research domain appeared almost twenty years ago that requires multidisciplinary knowledge in many domains such as physics (magnetism, thermodynamics, fluid mechanics, heat transfers), materials and forming processes.</p> <p>For ten years, the FEMTO-ST Institute has been working on magnetocaloric devices and magnetic materials, and several test benches have been developed in the laboratory's departments.</p> <p>The COMPOMAG project is focused on the manufacturing of thermoplastic highly loaded in MagnetoCaloric (MC) powder in order to obtain MC composite regenerators with specific microstructure on its surface. This structuring at microscopic level (i.e. geometric details at the surface) is required to facilitate the stacking up of the MC regenerator and to enhance the heat transfer and mixing in the fluid boundary layer simultaneously. Moreover, in order to improve dimensional accuracy, the use of finer granulometries of the powders is also required to explore and push the</p>

	<p>current limits of forming processes and consequently to increase the MC properties.</p> <p>This work will enable the development of innovative nanocomposites with specific functional properties to implement new MC devices that can be used at the end of the project for thermodynamic applications in industrial or domestic cooling and heat pumping.</p> <p>By optimizing the design of the heart of MC machine (performing micro-structured regenerator), it is about allowing the emergence of a low cost, environment-friendly industrial refrigeration technology sector, whether in the choice of materials (abundance, economy of rare earth) or in the choice of heat transfer fluids (no greenhouse gases, no ozone depleting power) or in congestion (high power density).</p> <p>In this project, the forming process of materials, the magnetic-dependant thermo-physical characterization of powders and developed components, the optimization based on multiphysics - multiscale analytical and numerical models will be also studied in details.</p> <p><u>Schedule tasks:</u></p> <p>The work of the PhD student will include the following major steps:</p> <ul style="list-style-type: none"> <li>- Elaboration and forming process of the magnetocaloric regenerators,</li> <li>- Mechanical and thermophysical characterization of materials and regenerators. The specific multiphysics characterizations on test samples will be developed,</li> <li>- Identification of constitutive laws, developement of multi-physics behavior models and identification of theirs parameters,</li> <li>- Study of the different multiphysics couplings and of the treatment strategy of them (without coupling, iterative approaches or fully coupled),</li> <li>- Simulations of the nanocomposite forming process and of the functional properties (magnetic, magnetocaloric... to be defined) of regenerators with different multiphysics approaches,</li> <li>- Optimization of the nanocomposite elaboration and forming process and of the functional properties (magnetic, magnetocaloric... to be defined).</li> </ul>
<b>Supervisor(s)</b>	<p>Thierry BARRIERE (Professor, UFC; FEMTO-ST Institute/Applied mechanics/Besancon)</p> <p>Laurent HIRSINGER (CR, CNRS; FEMTO-ST Institute/MN2S/Besancon)</p>
<b>Candidate profile</b>	<p>The candidate will be employed by FEMTO-ST and will benefit from the skills and experiences of the laboratory in the fields of mechanics, physics, energy and especially in computational modelings and simulations dedicated to non-linear multi-physics problems and engineering validations. She/he will be</p>

	<p>involved for simulation and optimization of magnetocaloric regenerators with different multiphysics approaches.</p> <p>Skills in mechanics, multiphysics modelling, material properties, identification is required. The candidate should be qualified in these fields and be motivated by physical modelling, numerical simulations in the set up to magnetocaloric research from theory to applications.</p> <p>A thorough knowledge of English and/or French is required. Experience in multiphysics platform, material behavior identification, multi-physics behavior and computational modelling, simulation and software engineering are favourable with an interdisciplinary approach.</p>
<b>Keywords</b>	Simulation and software engineering / Mechanics of Materials / High-loaded materials / Materials behaviour identification / Polymer / Magnetism and thermal coupling / Composites / Materials behaviour identification.
<b>Application deadline</b>	<del>30 June 2018</del> <b>As soon as possible</b>
<b>Application</b> <i>Depending on the type of position</i>	<p><b>PhD Position</b></p> <p>Please send the following documents (all in one PDF file) by e-mail to <a href="mailto:job-application@ubfc.fr">job-application@ubfc.fr</a>, <a href="mailto:laurent.hirsinger@femto-st.fr">laurent.hirsinger@femto-st.fr</a>, <a href="mailto:thierry.barriere@univ-fomte.fr">thierry.barriere@univ-fomte.fr</a>:</p> <ol style="list-style-type: none"> <li>1) For EU candidates: Copy of your national ID card or of your passport page where your photo is printed. For non-EU candidates: Copy of your passport page where your photo is printed.</li> <li>2) Curriculum Vitae (1 page).</li> <li>3) Letter of motivation relative to the position (1 page).</li> <li>4) Copy of your Master degree if already available.</li> <li>5) Copy of your final marks and ranks.</li> <li>6) Letter(s) of recommendation and the coordinates of reference persons (maximum 3, at least your master thesis supervisor): Title, Name, Organization, e-mail.</li> </ol> <p>If you have questions regarding the application, please contact the thesis supervisors and/or the <b>COMPOMAG</b> Project manager.</p> <p>Laurent HIRSINGER (CR, CNRS; FEMTO-ST Institute/MN2S/Besancon), <a href="mailto:laurent.hirsinger@femto-st.fr">laurent.hirsinger@femto-st.fr</a></p> <p>Thierry BARRIERE (Professor, UFC; Institut FEMTO-ST/Applied mechanics/Besancon), <a href="mailto:thierry.barriere@univ-fomte.fr">thierry.barriere@univ-fomte.fr</a></p>