



# PhD in CHIMICA INDUSTRIALE E INGEGNERIA CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 39th cycle

**THEMATIC Research Field: SUSTAINABLE ELASTOMER NANOCOMPOSITES WITH  
INORGANIC OXYHYDROXIDES AND FUNCTIONALIZED ELASTOMERS**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1400.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

## Context of the research activity

**Motivation and objectives of the research  
in this field**

The role of transport in sustainable development is well recognized by the United Nations <https://www.epa.gov/sustainability>. Tyres play a fundamental role in transporting people and goods and do have impact on the environment, mainly during their life because of the rolling resistance (RR). Elastomer nanocomposites find their main application in tyre compounds. To reduce the rolling resistance of a tyre, a reinforcing filler such as silica and functionalized elastomers are used in the elastomer nanocomposites for tyre compounds. Silica is able to establish a chemical bond with the elastomer matrix through the use of a coupling agent and is as well able to interact with the functionalized elastomers, and such a network gives the fundamental contribution for the reduction of RR.

Main objective of the research is to design, prepare and characterize elastomer nanocomposites based on inorganic oxyhydroxides and functionalized elastomers, studying their interactions and the correlation with the composite properties. The research aims at preparing and studying novel nanocomposites, working in line with the rules of green and sustainable chemistry, in order to promote innovation in the industrial development thanks to long-term sustainability goals. See <https://www.pirelli.com/global/en-ww/life/sustainability/>.



	<p>Further objective of the research is to obtain elastomer nanocomposites which can meet the demanding requirements of the dynamic-mechanical application of a tyre compound, reducing the dissipation of energy of a tyre during its use.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The role of transport in sustainable development is well recognized by the United Nations <a href="https://www.epa.gov/sustainability">https://www.epa.gov/sustainability</a>. Tyres play a fundamental role in transporting people and goods and do have impact on the environment, mainly during their life because of the rolling resistance (RR). Elastomer nanocomposites find their main application in tyre compounds. To reduce the rolling resistance of a tyre, a reinforcing filler such as silica and functionalized elastomers are used in the elastomer nanocomposites for tyre compounds. Silica is able to establish a chemical bond with the elastomer matrix through the use of a coupling agent and is as well able to interact with the functionalized elastomers, and such a network gives the fundamental contribution for the reduction of RR. Main objective of the research is to design, prepare and characterize elastomer nanocomposites based on inorganic oxyhydroxides and functionalized elastomers, studying their interactions and the correlation with the composite properties. The research aims at preparing and studying novel nanocomposites, working in line with the rules of green and sustainable chemistry, in order to promote innovation in the industrial development thanks to long-term sustainability goals. See <a href="https://www.pirelli.com/global/en-ww/life/sustainability/">https://www.pirelli.com/global/en-ww/life/sustainability/</a>. Further objective of the research is to obtain elastomer nanocomposites which can meet the demanding requirements of the dynamic-mechanical application of a tyre compound, reducing the dissipation of energy of a tyre during its use.</p>
<p><b>Educational objectives</b></p>	<p>The activity is aimed at giving high education, allowing the student to be able to:</p> <ol style="list-style-type: none"> <li>1. perform chemical reactions inspired by the principles of green and sustainable chemistry</li> </ol>



	<p>2. prepare and characterize low and high molar mass chemicals</p> <p>3. prepare and characterize elastomer nanocomposites.</p>
<b>Job opportunities</b>	The Research Doctor will be able to find a location, in particular in R&D Department, both in private and public companies and institutes active in the field of chemical synthesis, preparation of polymer composites, elastomer nanocomposites in particular for tyre application, high performance applications.
<b>Composition of the research group</b>	<p>1 Full Professors</p> <p>3 Associated Professors</p> <p>2 Assistant Professors</p> <p>9 PhD Students</p>
<b>Name of the research directors</b>	Prof. Galimberti - Dr. Barbera

#### Contacts

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#### Additional support - Financial aid per PhD student per year (gross amount)

<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

#### Scholarship Increase for a period abroad

<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

#### Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

**Confidentiality (Agreement with company):** since this is a thematic scholarship, the management of Confidential Information, Results and their publication is subordinate to the restrictions agreed upon with the funding company. Upon acceptance of the scholarship, the beneficiary must sign a specific commitment.

**Individual budget for research (5.700 euro):** 1<sup>st</sup> year: 1.900 euro; 2<sup>nd</sup> year: 1.900 euro; 3<sup>rd</sup> year: 1.900 euro

**Teaching assistantship (availability of funding in recognition of supporting teaching**



**activities by the PhD student):** there are various forms of financial for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities within the limits allowed by the regulation.