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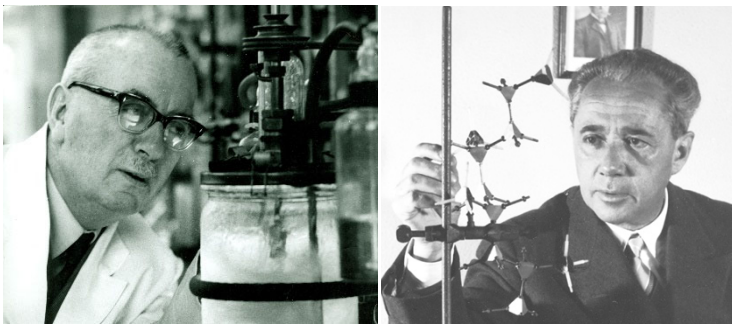
# Chemistry overcomes borders and boundaries

## Italian and German institutions share "Historical Landmark" award of the European Chemical Society



Prof. Karl Ziegler (left) and Prof. Giulio Natta both received the Nobel Prize in chemistry in 1963 for their work on polymers.

**Milan/Mülheim** It was December 10th in the year 1963 when two outstanding chemists from Italy and Germany shared the stage of the Stockholm Concert Hall. Giulio Natta and Karl Ziegler were awarded the Nobel Prize in chemistry for their work on polymers that "paved the way for new and highly useful industrial processes." In other words: With their pioneering work in the field of catalysis, the two scientists had initiated nothing less than the age of plastics. While this highest recognition of the scientific community was bestowed upon them in Sweden and the effects of their discoveries played a role worldwide, it was their laboratories in Milan and Mülheim where Natta and Ziegler conducted the decisive experiments. These are the "Giulio Natta" Department of Chemistry, Materials and Chemical Engineering at the Politecnico in Milan, Italy, and the Max-Planck-Institut für Kohlenforschung in Mülheim an der Ruhr, Germany.

Now, more than 60 years after their joint Nobel Prize ceremony of Natta and Ziegler, the European Chemical Society (EuChems) has recognized both locations als "Historical Landmark". With this award, the EuChems wants to point out that both Milan and Mülheim are places that are important to the European Chemical community and both inspire a sense of European belonging. Natta's and Ziegler's groups were tightly bonded by their cooperative and also competitive research and development activities. Until today, "Ziegler-Natta" is a well-known term among students in the field of Chemistry. And their impact on our everyday life is still immense, as the EuChems underlines.

Yes, synthetic polymers had already existed since the end of the 19th century, but they were not yet of high interest for the chemical industry. Their material properties were partly unsatisfactory, their production often very expensive and only possible under high pressures. Ziegler's research team discovered in 1953 that organometallic compounds could catalyze the

production of polyethylene without the need for high pressure and temperature, leading to high-density polyethylene. This type of polyethylene proved superior to the previously manufactured products due to its better properties and more economical production. Natta extended the research conducted by Ziegler to stereospecific polymerization, thus discovering new classes of polymers with a sterically ordered structure. These studies led to the production of a thermoplastic material, isotactic polypropylene, which was soon marketed successfully as a plastic material for fibers and films.

The discovery of Ziegler-Natta catalysts and the resulting new polymers was disruptive to chemical research and industry and to everyday life on a global scale, with special consequences for the Italian early stage researchers nationwide.

The enduring impact of Professors Ziegler and Natta's accomplishments extends far beyond Germany and Italy, and continue to yield significant contributions to polymerization catalysis, polymer science, and the polymer industry, with particular emphasis nowadays toward establishing a fully sustainable polymer industry.

"We are delighted that EuChems has included the work sites of Giulio Natta and Karl Ziegler in its important Historical Landmarks program," explains Prof. Dr. **Sabine Becker, Vice President of the GDCh**. "In Milan and Mülheim, Natta and Ziegler made outstanding and groundbreaking chemical achievements in the field of polymer science, from which the entire society still benefits enormously today."

“Stereoregular polymers already existed in nature at the time of the discoveries of Professors Ziegler and Natta, for example cellulose and natural rubber. As it was stated on the occasion of the awarding of the Nobel prize, Prof. Natta’s research broke the monopoly of nature for the synthesis of stereoregular polymers with a high degree of order. Isotactic polypropylene is the best known example and is the most widely used polymer today. The scientific and technological revolution promoted by the Ziegler-Natta catalysis led to immense advancements” states **Marinella Levi, Director of the Chemistry, Materials and Chemical engineering “G. Natta” Department**. The legacy of Professors Ziegler and Natta and their Schools is fundamental to shape our future, which must be inspired by the sustainability of polymeric materials.

“We are very proud of Karl Ziegler's legacy, without whom our institute in Mülheim would never have grown to the size we know it as today”, says **Frank Neese, Managing Director at the Max-Planck-Institut für Kohlenforschung**. Ziegler with his groundbreaking work in the field of organic chemistry, he was one of the founders of organometallic chemistry and, in particular, organometallic catalysis. His patent for the production of high molecular weight polyethylene at normal pressure and room temperature with the aid of "organometallic catalysts" made from aluminum alkyl and transition metal compounds started a chain of innovation, which led to the rapid development of the large-scale production of polyolefins.

The age of plastics did not only bring countless useful applications for synthetic polymers. Nowadays humankind has to face the still uncontrolled disposal of plastic waste. The two historical landmarks could be a perfect opportunity to show to the general public environmental sustainability of polymers as well as to underline modern contributions of Chemistry to Circular Economy.