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Professor Sukwon Hong's research team develops a new catalyst capable of synthesizing functional polyolefin, a raw material for plastics

□ GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) Department of Chemistry Professor Sukwon Hong's research team has developed a new catalyst for polymerization that can synthesize functional polyolefin, which can be used as a material for plastic.

- Catalysts necessary for the synthesis of polyolefin *, an essential raw material for the manufacture of plastic products existing in our daily lives, is very important because it can control the structure and properties of polyolefin.

* polyolefin: A polymer of olefins (chain-type or ring-type unsaturated hydrocarbon containing one or more double bonds), a type of polymer compound. It is cheap compared to other materials and has excellent physical properties.

□ Professor Sukwon Hong's research team used a carbene palladium catalyst to synthesize high molecular weight polymers of linear polyolefin, which have not been shown before, with functional polyolefin polymerization catalyst using the existing carbene ligand.

- The team succeeded in synthesizing polyethylene and polypropylene through the developed catalyst. Polyolefin is a general-purpose polymer showing the characteristics of chemical stability, mechanical properties, light weight, and transparency. In addition, by adding polar olefins having various types of functional groups, various types of functional polyolefins capable of adhesion,

miscibility, painting, etc., which cannot be seen in the properties of polyolefins, were synthesized.

- The catalyst developed this time is composed of carbene ligand and palladium transition metal, and it contributed to increase of thermal stability and catalytic activity of the catalyst in the polymer reaction by introducing a high electron density and tricyclic rigid carbene ligand.
 - The newly developed carbene ligand has a strong electron donation property by performing computational chemistry and IR spectroscopy experiments, and it is confirmed that it plays an important role in the synthesis of high molecular weight polyolefins.
- In addition, in the case of functional polyolefin polymerization, it succeeded in synthesizing functional polyolefin having a polar functional group content of up to 6 times that of the existing catalyst under the same polymerization conditions. Therefore, the result of this research opened the possibility of utilization in a wide range of plastic applications from vinyl packaging to communication cables.
- Professor Sukwon Hong said, "The result of this research is significant in confirming that it is possible to synthesize various types of polymers such as polyolefins as well as functional polyolefins by developing a catalyst for polymer polymerization. It is expected that a higher performance catalyst will be developed by presenting an important direction in the design of new ligands for the development of catalysts for polymer polymerization."
- This research was led by Professor Sukwon Hong (corresponding author) and Ph.D. student Da-Ae Park (first author) and was supported was supported by LG Chemical and also by the Technology Development Program to Solve Climate Changes through the National Research Foundation (NRF) funded by the Ministry of Science, ICT & Future Planning. The research was published online on April 13, 2020, in *ACS Catalysis*, a world-class academic journal in the field of catalysts published by the American Chemical Society.

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