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Professor Dong-Yu Kim's research team identifies polymer aggregation type for high performance organic thin film electronic devices

- GIST (President Kiseon Kim) – The research team of Professor Dong-Yu Kim of the School of Materials Science and Engineering succeeded in identifying polymer aggregation type for high performance organic thin film electronic devices.
- Conjugated polymers, which are organic semiconducting materials, can be processed in solution to reduce the cost of the process, and it has attracted attention as a next-generation semiconductor material because of its high compatibility with light and flexible wearable electronics.
 - However, organic semiconductors based on transistors have a somewhat lower performance than inorganic semiconductors, making them difficult to commercialize. Therefore, for successful commercialization of wearable electronic devices, it is essential to identify the causes of the performance improvement of the polymer material itself.

- To identify these causes, the research team synthesized polymers with three-dimensional differences and confirmed through various analytical methods that different types of polymers can be formed between macromolecules under film conditions. It is expected that this will be used as a guide in the development of core materials for flexible electronic devices, displays, and wearable electronic devices.
 - The difference in the form of polymer aggregation found by this research team is due to the difference in the form when the polymers are stuck together in a state of freedom. The existence of H-aggregation in a fully overlapping form and X-aggregation formed by combing each other in the shape of an X-aggregation has been identified, which is also closely related to the overlap of the electron cloud, to affect the performance of the polymer.
 - In addition, polymer aggregates of different kinds showed very large charge mobility (maximum $1.544 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ / charge mobility difference of 10 times) at organic thin film transistors fabricated using organic thin film fabrication methods, indicating that there is a polymer aggregation type suitable for charge transfer.
- Professor Dong-Yu Kim said, "In his study, we have investigated the causes of polymer performance in various thin films, which have been reported previously, that relates to the orientation of the polymer chains. This study suggests a new method for structural insight that can further improve the understanding of the structural accumulation of polymer chains and intermolecular orbitals."
- This research was led by the School of Materials Science and Engineering Professor Dong-Yu Kim (corresponding author) with Ph.D. students Dae-Hee Lim and Yeon-Ju Kim as co-first authors, and was supported by the National Research Foundation of Korea (NRF), the Korea Institute of Energy Technology Evaluation and Planning (KETEP), and the Ministry of Trade, Industry & Energy (MOTIE) of the Republic of Korea.

- The research was published in *Chemistry of Materials* (IF: 9.890), and renowned international journal, in April. It will also be selected for the front cover in July 2019 in recognition of its importance to academia and the public.

