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Does synergistic effect only exist in layers?

Yuya Oaki

While it may be overly ambitious, for me the synergistic effect is more significant than 1+1 = greater than or equal to 2. I believe that its multiplicative potency is as powerful as the '*n*' in 2^n, like the *baibain* from Doraemon that I introduced earlier from my bookshelf.

As you've mentioned in this publication, I am conducting research with the aim of creating soft and functional two-dimensional materials. In order to move and work the incorporated molecules, we are synthesizing materials with a soft, two-dimensional anisotropic structure. To explain more concretely, we take the "ingredients" of heteroaromatic polymers such as polypyrrole, quinone derivatives, layered polydiacetylenes, and layered inorganic compounds, then shape them into two-dimensional "structures" such as nanosheets or flexible network polymers, thus enhancing molecular motion for the dynamic functions. These products can then be used in various applications such as in lithium ion secondary batteries, hydrogen-generating electrocatalysts, light/heat/force sensors, etc. Using these avenues I hope my research can make contributions to medical care, environmental needs, energy issues, and resource management.

By combining the synergy between materials' properties (derived from its molecules and compounds) and the two-dimensional anisotropic structure, we hope improve performance and develop new functions that were not previously possible in the modern world. Under the framework of the aforementioned structural/functional research topic, my students are tasked with the thorough investigation of what makes this research new when compared to other studies, what materials can only be made via these methods, and what unique performance/functions are made possible by the developed materials. Young students have extraordinary brains and abilities that I lack. Like my research, I have discovered a "synergy" when I have involved students in the process, leading to major breakthroughs and unexpected discoveries.

When I think back on it all, there have been all kinds of serendipitous moments that have occurred because of this synergy—whether it was through a student bringing me their experiment samples as I passed by, an experiment that I personally thought was pointless but then gave surprising results, students taking ownership of difficult programs or principles, or the simple power of countless experiments and sheer will. My job very well may be to create an environment that produces that synergy, harnessing the collective power of my students.

I also find that synergy when working with researchers inside and outside the university. For example, in "Materials Informatics," which accelerates the research and development of materials based on data, we are indebted to a professor who is an expert in data science. Collaboration with researchers from different fields such as data science, doctors, and researchers in industry, not to mention collaboration with researchers in the closely-related fields like polymer chemistry, garners new insights for both students and myself every time we interact, resulting in a great synergistic effect on research. Using the synergy from all of these areas, I hope to harness the power of the "*n*" in 2^n to conduct the best research possible.

理 工 学 Information

KEIO TECHNO-MALL 2021 22nd Annual Keio Science and Technology Exhibition "Beyond imagination: encouraging advances to the future"

The KEIO TECHNO-MALL is an event showcasing the research findings of Keio University's Faculty and Graduate School of Science and Technology and the Keio School of Medicine, as well as a platform to facilitate collaboration between industry, government, and academia through joint research projects, technology transfers, and more. We pride ourselves that the event is the one of the largest exhibitions held by a science and engineering university, with numerous participants, ranging from private corporations, government entities, and other universities, attending each year.

In order to prevent the spread of COVID-19, this year's proceedings will be held online as they were last year. The event will utilize online tools and platforms and deliver interactive sessions to recreate the experience of visiting booths at the actual event. While you won't be able to experience the real thing, we hope that you will enjoy the features unique to the revamped online KEIO TECHNO-MALL We also hope that those who have faced physical difficulties attending previous events will seize the opportunity to join us online. See you at KEIO TECHNO-MALL!

Date and time: 10:00–18:00, Friday, December 10, 2021
Details: Research Exhibition
(featuring research explanations, introductory videos, and other materials)
-Live events and panels will be offered throughout the day
-Introduction of online research
Host: Keio Leading-edge Laboratory of Science and Technology (KLL)
(Keio University Faculty and Graduate School of Science and Technology, School of Medicine)
For more details: www.kll.keio.ac.jp/ktm/

Editor's postscript

Associate Professor Yuya Oaki says that he learns a lot from the watching the interactions of working researchers and that he appreciates the very "human" element of the event. Listening to stories from his pupils, it appears that Oaki himself has become a respected figure in their eyes. Considering the exemplary behavior he showed to our staff while gathering materials for this article, the care he took in providing drinks for everyone, and the professionalism he displayed in proofreading the manuscript, we hope that our article will highlight his attention to detail and courteous personality.

This issue marks the first publication since the COVID-19 pandemic began. As such students are pictured wearing masks while conducting their research. We hope that by the time of the next publication, things on campus will have returned to normal. (Yurina Tomohisa)

Cover of current issue : Professor Oaki standing next to an atomic force microscope for examining nanosheets.

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