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What brought you to NanoChem for exchange?

I'm currently a PhD student at RPTU Kaiserslautern, Germany, working on magnetometry with nitrogen-vacancy (NV) centers in diamonds. My interest in interdisciplinary research motivated me to join Japan's NanoChem group. Specifically, investigations on pH sensing with NV centers in diamond at NanoChem group combine topics covered in my PhD studies in Kaiserslautern and extend them to practical applications. Professor Fujiwara and I came into contact through one of my previous publications about NV-center relaxometry, a technique for environmental sensing. After he visited Kaiserslautern in 2023, he invited me to join his group for a collaborative research project. During my stay, I hoped to combine physics with chemistry in a single experiment – sensing the pH of aqueous solutions with NV centers in a quantum diamond microscope. Additionally, I wanted to explore the country of Japan and learn about its culture. I expected to use my abilities in the physics and chemistry laboratory to examine fluorescent nanodiamonds' properties in solution. Further, I was looking forward to meeting new colleagues in Japan and working together with them in the laboratories.

What did you work on during your stay?

During my time at NanoChem, I worked on investigating the effects of electrochemical potentials on NV centers in diamond in an electrochemical cell and pH sensing with the NV-center T_1 relaxation time.

The research at the NanoChem group extended my skills by probing NV centers in nanodiamonds in solution, which I had not performed during my earlier PhD studies. Since I studied chemistry and am now a PhD student in physics, I combined my two scientific backgrounds in a single experiment. The research takes place in collaboration with the Institute of Science Tokyo (ISCT), including the group of Prof. Keigo Arai.

Within my studies, I investigated NV centers within nanodiamonds in solution. Applying voltages to the nanocrystals in an electrochemical cell alters the two charge states of the color center, NV^- and NV^0 . Additionally, I probed the T_1 time in aqueous solutions of varying pH. We observe a dependence of the T_1 time on the pH, which remains repeatable

over several cycles of exchanging the solutions. Our results pave the way for applications of the NV center in diamond as a pH sensor.

🌸 What impressed you the most about NanoChem and Japan?

I genuinely enjoyed my stay at NanoChem group and in Japan. In the lab, everybody works together as a team, and my colleagues at the NanoChem group always help me when I have questions. Since the NanoChem group focuses on interdisciplinary research, you can find physics, chemistry, and biology experts here. During lunch, we often discussed differences and similarities between Germany and Japan, which sometimes led to surprises due to our different cultural backgrounds. I immensely enjoyed the Japanese food at the cafeteria – from Soba over Raamen to Udon, Obento boxes, and rice bowls; it is a paradise for food lovers! I also used my stay to travel around Japan and visit Osaka, Kyoto, Hiroshima, Himeji, Kurashiki, and Takamatsu. Since traveling in a foreign country is not always straightforward, I was glad that the people at the Tourist Information Center at JR Okayama Station were happy to help me with my questions.

💬 Any messages for future visitors?

If you're considering coming to NanoChem, stop overthinking and do it! It is not only a perfect opportunity to learn about applied research but also to explore the beauty of Japan. The laboratories will teach you research perspectives and new techniques, and you will learn about Japanese culture and experience its fascinating landscape, architecture, and other cultural aspects. Every city I visited, including Okayama, left me in awe, and I will always keep these memories in my heart.

I am incredibly thankful for the opportunity to research at the NanoChem group. I express my deepest gratitude to Professor Fujiwara and Okayama University for choosing me as an exchange student in their program.