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## ABSTRACT:

### Substrate Modification and Surface Engineering for the Growth of Germanene

J. Yuhara

Nagoya University, Chikusa-ku, Nagoya, Aichi, 464-8603, Japan

Germanene, the germanium analogue of graphene, has emerged as a compelling twodimensional material due to its buckled honeycomb structure and the potential for a significant spin-orbit gap. Since our first report on the synthesis of high-quality, largescale ( $7\sqrt{7}\times 7\sqrt{7}$ )R19.1° germanene on Ag(111) thin films [1], we have focused on controlling its structural phases and electronic properties through precise surface modification [2–12]. In this talk, I will review the evolution of epitaxial germanene growth and our recent studies. Our previous work established the fundamental growth mechanisms and identified various structural transitions [6–8,12,13] as well as environmental stability. While these studies demonstrated the versatility of germanene, the strong substrate-germanene interaction remained a challenge for preserving its intrinsic electronic properties [11]. The recent study on intercalation beneath the germanene layer is also introduced [13].

- [1] J. Yuhara, H. Shimazu, K. Ito, A. Ohta, M. Araidai, M. Kurosawa, M. Nakatake, G. Le Lay, ACS Nano 12 (2018) 11632–11637.
- [2] J. Yuhara, G. Le Lay, Jpn. J. Appl. Phys. 59 (2020) SN0801.
- [3] T. Ogikubo, H. Shimazu, Y. Fujii, K. Ito, A. Ohta, M. Araidai, M. Kurosawa, G. Le Lay, J. Yuhara, Adv. Mater. Interfaces 7 (2020) 1902132.
- [4] S. Mizuno, A. Ohta, T. Suzuki, H. Kageshima, J. Yuhara, H. Hibino, Appl. Phys. Express 14 (2021) 125501.
- [5] J. Yuhara, H. Muto, M. Araidai, M. Kobayashi, A. Ohta, S. Miyazaki, S. Takakura, M. Nakatake, G. Le Lay, 2D Mater. 8 (2021) 045039.
- [6] J. Yuhara, H. Shimazu, M. Kobayashi, A. Ohta, S. Miyazaki, S. Takakura, M. Nakatake, G. Le Lay, Applied Surface Science 550 (2021) 149236.
- [7] J. Yuhara, D. Matsuba, M. Ono, A. Ohta, S. Miyazaki, M. Araidai, S. Takakura, M. Nakatake, G. Le Lay, Surface Science 738 (2023) 122382.
- [8] J. Yuhara, S. Maeda, D. Katsube, S. Suzuki, T. Terasawa, S. Takakura, M. Nakatake, G. Le Lay, 2D Mater. 12 (2025) 045023.
- [9] A. Molle, J. Yuhara, Y. Yamada-Takamura, Z. Sofer, Chem. Soc. Rev. 54 (2025) 1845–1869.

- [10] H. Hibino, A. Ohta, H. Kageshima, J. Yuhara, *Jpn. J. Appl. Phys.* 64 (2025) 050906.
- [11] S. Suzuki, D. Katsube, M. Yano, Y. Tsuda, T. Terasawa, T. Ozawa, K. Fukutani, Y. Kim, H. Asaoka, J. Yuhara, A. Yoshigoe, *Small Methods* 9 (2025) 2400863.
- [12] M. Ohno, A. Ohta, Y. Ando, S. Takakura, M. Nakatake, M. Kurosawa, J. Yuhara, *Physica Status Solidi (RRL) – Rapid Research Letters* 20 (2026) e202500186.
- [13] D. Matsuba, M. Araidai, A. Ohta, M. Kurosawa, J. Yuhara, submitted (2026).