SiGe Materials by Molecular Beam Epitaxy for Quantum Computing

Jie-Yin Zhang[1, 3], **Ming Ming**[2], **and Jian-Jun Zhang**[2]

[1]Songshan Lake Materials Laboratory, Dongguan, Guangdong, China
[2]Institute of Physics, Chinese Academy of Sciences, Haidian, Beijing, China
[3]Dongguan Institute of Materials Science and Technology
Chinese Academy of Sciences, Dongguan, Guangdong, China

Abstract— Semiconductor quantum dot is one of the promising ways to realize solid-state quantum computing. The key is to obtain high-quality semiconductor quantum computing materials. Silicon and Germanium can be isotopically purified to achieve nuclear spin-free isotopes, meeting the requirement for long decoherence time. They are also compatible with the current CMOS technology, thus making them ideal material platforms for large scale integration. This presentation will introduce the preparation methods, material properties [1–5], and research progress of corresponding quantum devices [6] for silicon-based silicon/germanium heterojunctions, germanium/silicon germanium heterojunctions, and germanium/silicon one-dimensional wires based on molecular beam epitaxy technology.

REFERENCES

1. Geng, X., et al., *Acta Physica Sinica*, Vol. 73, No. 11, 2024.
2. Liao, L. X, et al., *Acta Physica Sinica*, Vol. 74, No. 12, 2025.
3. Wang, J. H., et al., *Nano Letters*, Vol. 25, No. 28, 11125–11133, 2025.
4. Zhang, J. Y., et al., *Acta Physica Sinica*, Vol. 70, No. 21, 2021.
5. Zhang, J. Y., et al., *Applied Physics Letters*, Vol. 125, No. 12, 2024.
6. Liu, H., et al., *Nano Letters*, Vol. 23, No. 9, 3810–3817, 2023.