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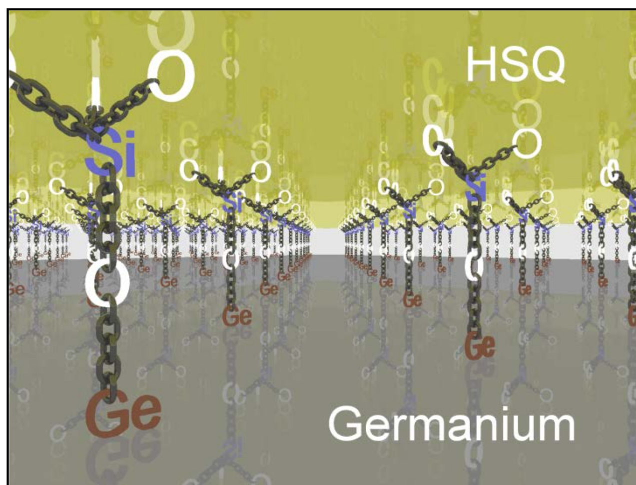
# High Resolution Lithography for Germanium

Electron beam lithography (EBL) using a high resolution resist such as hydrogen silsesquioxane (HSQ) is capable of **producing higher densities of devices** than current lithographic processes used on an industrial scale. Furthermore, devices produced from germanium can exhibit **superior speed and electrical performance** compared to their silicon analogues.

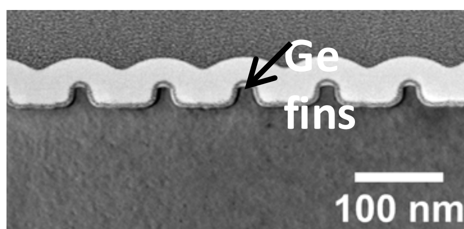
At present it is not possible to use HSQ resist for EBL directly on germanium surfaces because the resist requires the use of an aqueous solvent, which dissolves germanium surface oxides. This invention **enables the use of HSQ as an EBL resist** on germanium wafers, through a chemical pre-treatment process, thereby allowing the fabrication of **miniaturised germanium high speed devices** having high density nano-scale features.



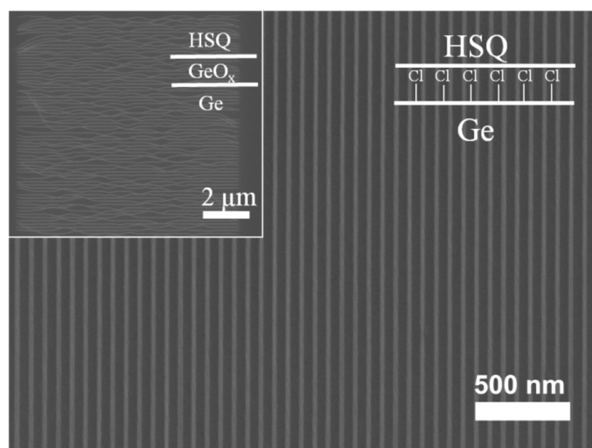

*Cross-linking of the HSQ resist to the Ge crystal facilitates high-resolution EBL on Ge surfaces.*

## Advantages

- Enables use of HSQ as a resist on germanium wafers
- Can produce germanium fin structures- lateral dimensions of 20 nm and pitch < 100 nm
- Cost effective
- Stabilises Ge surface




*The HSQ line pattern can be transferred to the Ge substrate allowing production of Ge nanofin arrays.*




*EBL using HSQ resist on $GeO_x$ results in delamination of HSQ lines during immersion in developer solution. Removal of $GeO_x$ and chlorination of the Ge crystal enables straight sub-20 nm HSQ line structures on Ge.*

## Applications

The technology is applicable to the semiconductor market. The final product will be a processing method to enable the use of HSQ resist for lithographically patterning germanium surfaces at high resolution for application in the semiconductor industry to fabricate devices which use germanium such as:

- Transistors
- Optical devices
- Solar cells

## Technology and Patent Status:

A patent has been filed on this technology.

## The opportunity

Lithography is the most important semiconductor process and the process which is attracting the most investment for R&D.
We are seeking one or more licensees to commercialise this technology.

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