



The
University
Of
Sheffield.



Effect of As species on growth of GaAsBi

Robert Richards

R.Richards@sheffield.ac.uk



E-Futures

Motivation for this work

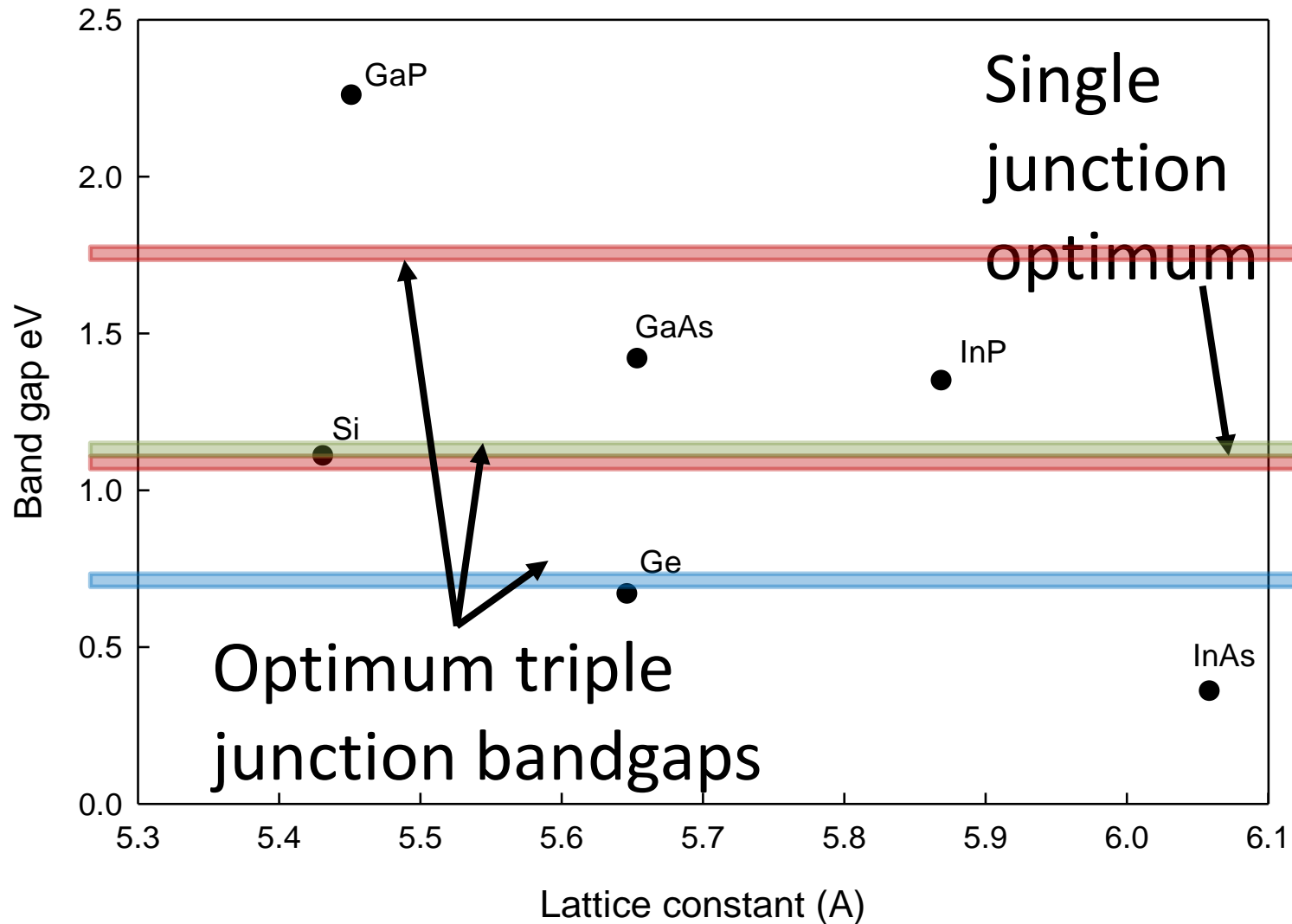
Why GaAsBi?

My research:

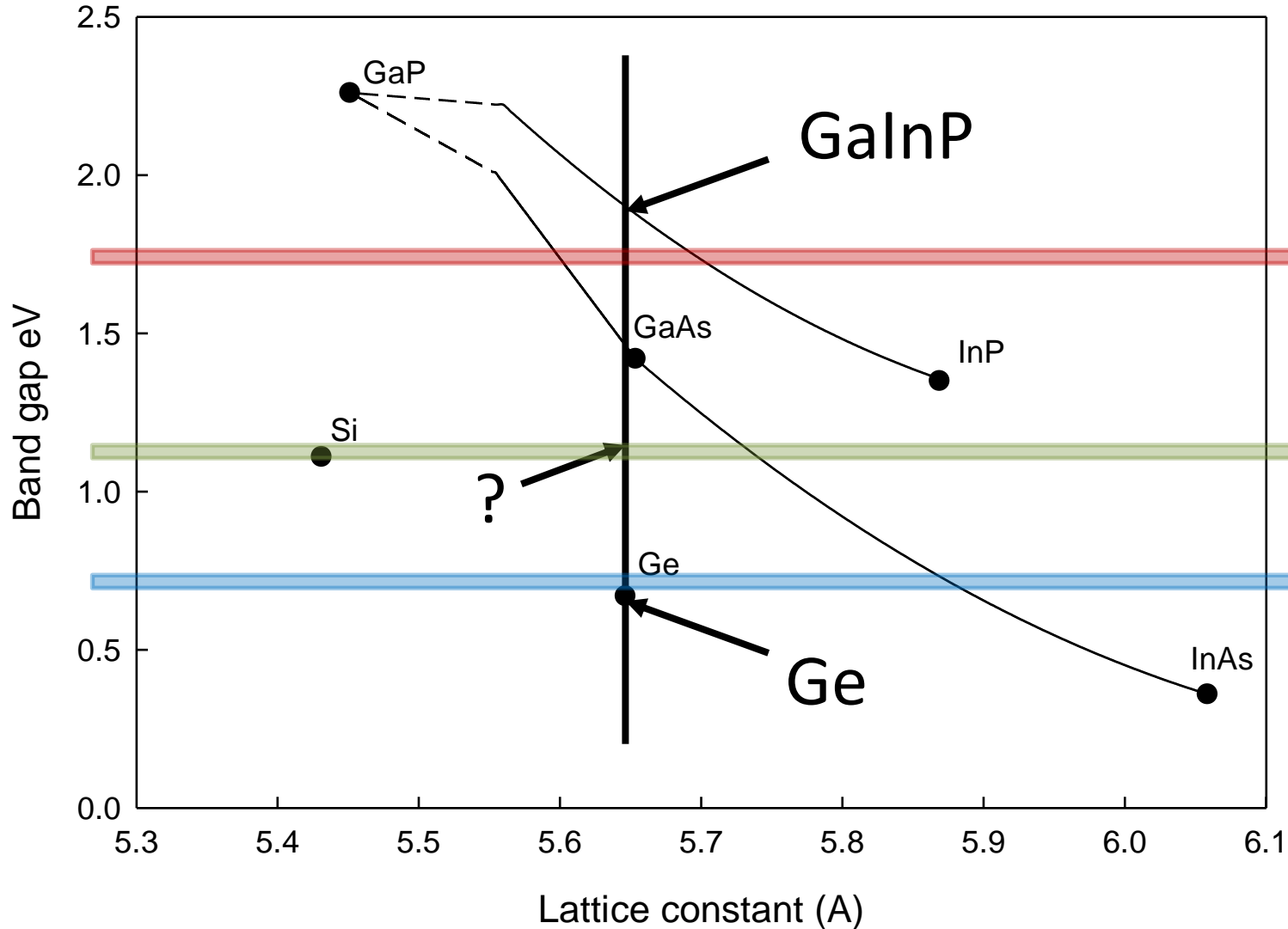
- As_2 versus As_4
- [Bi] versus growth temperature
- [Bi] versus flux ratios

Conclusions

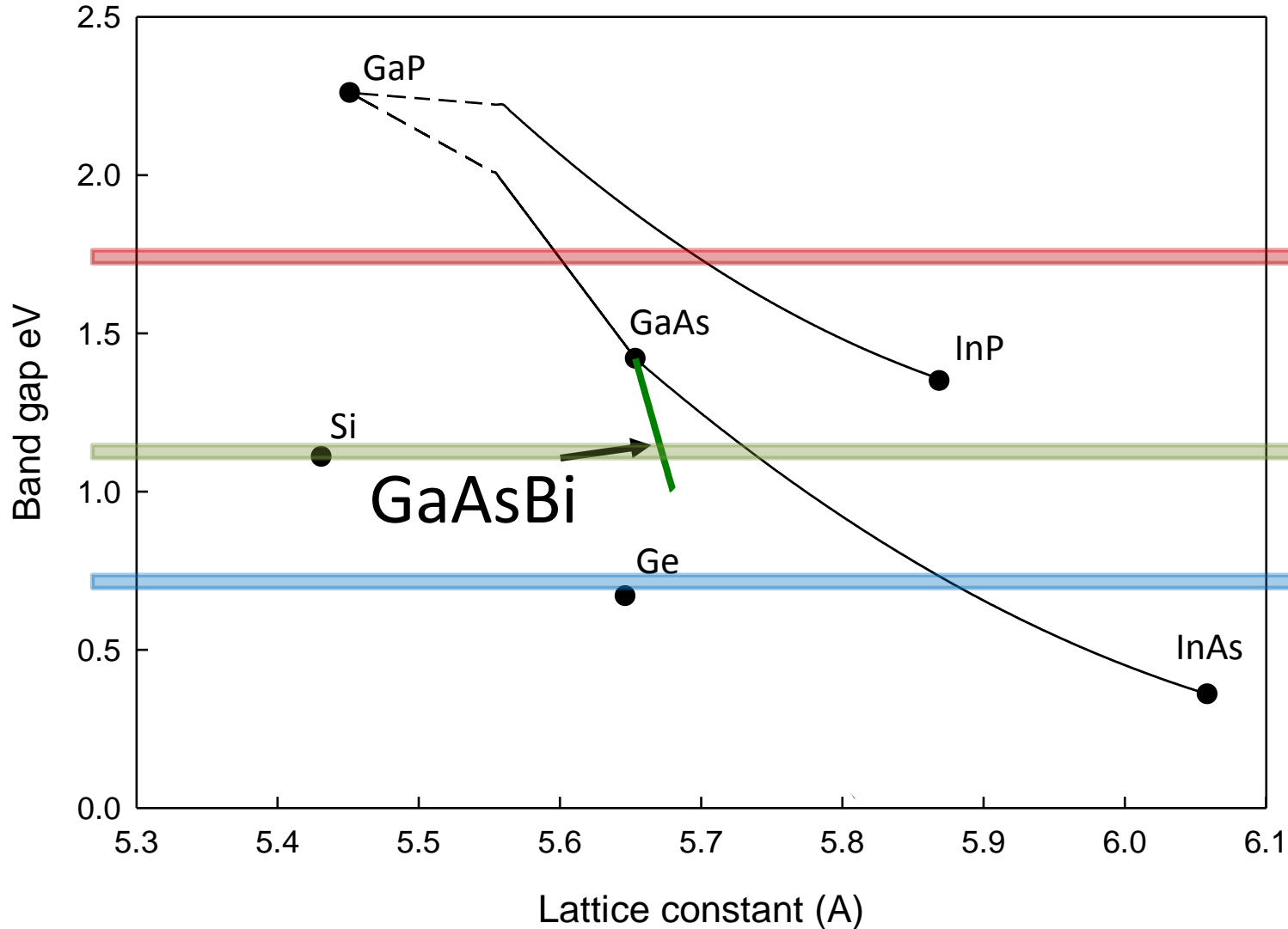
Semiconductor bandgaps



Bandgap engineering



Large E_g reduction with [Bi]



As₂ vs As₄ for GaAs

As₂ has been shown to produce better quality GaAs at low growth temperatures

Improvement ascribed to simpler surface reactions

As₂ has been adopted for GaAsBi growth

As₂ vs As₄ for GaAsBi

Unconventional growth parameters required for GaAsBi with As₂

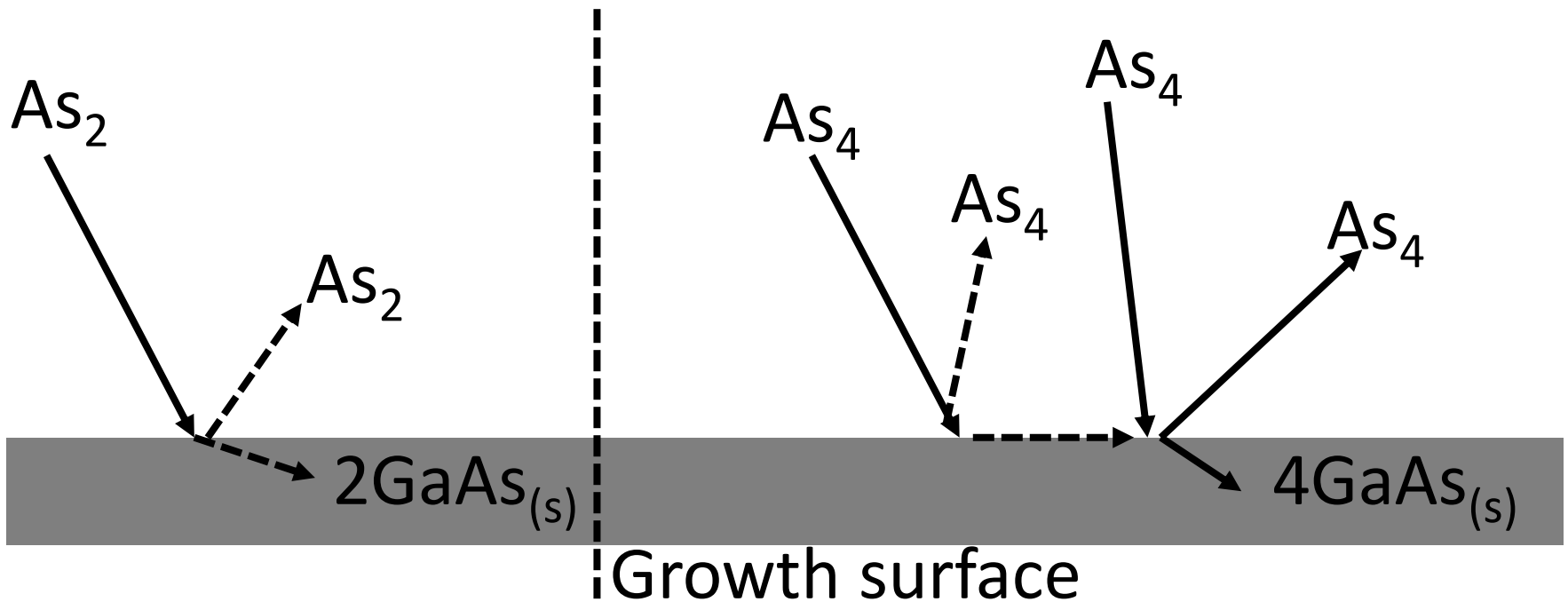
- Low T
- Near stoichiometric Ga:As

It has been shown that excess As₄ fluxes can be used to produce high quality GaAsBi

Bastiman, F., et al., *Non-stoichiometric GaAsBi/GaAs (100) molecular beam epitaxy growth*. Journal of Crystal Growth, 2012. **338**(1): p. 57-61.

As₂ vs As₄

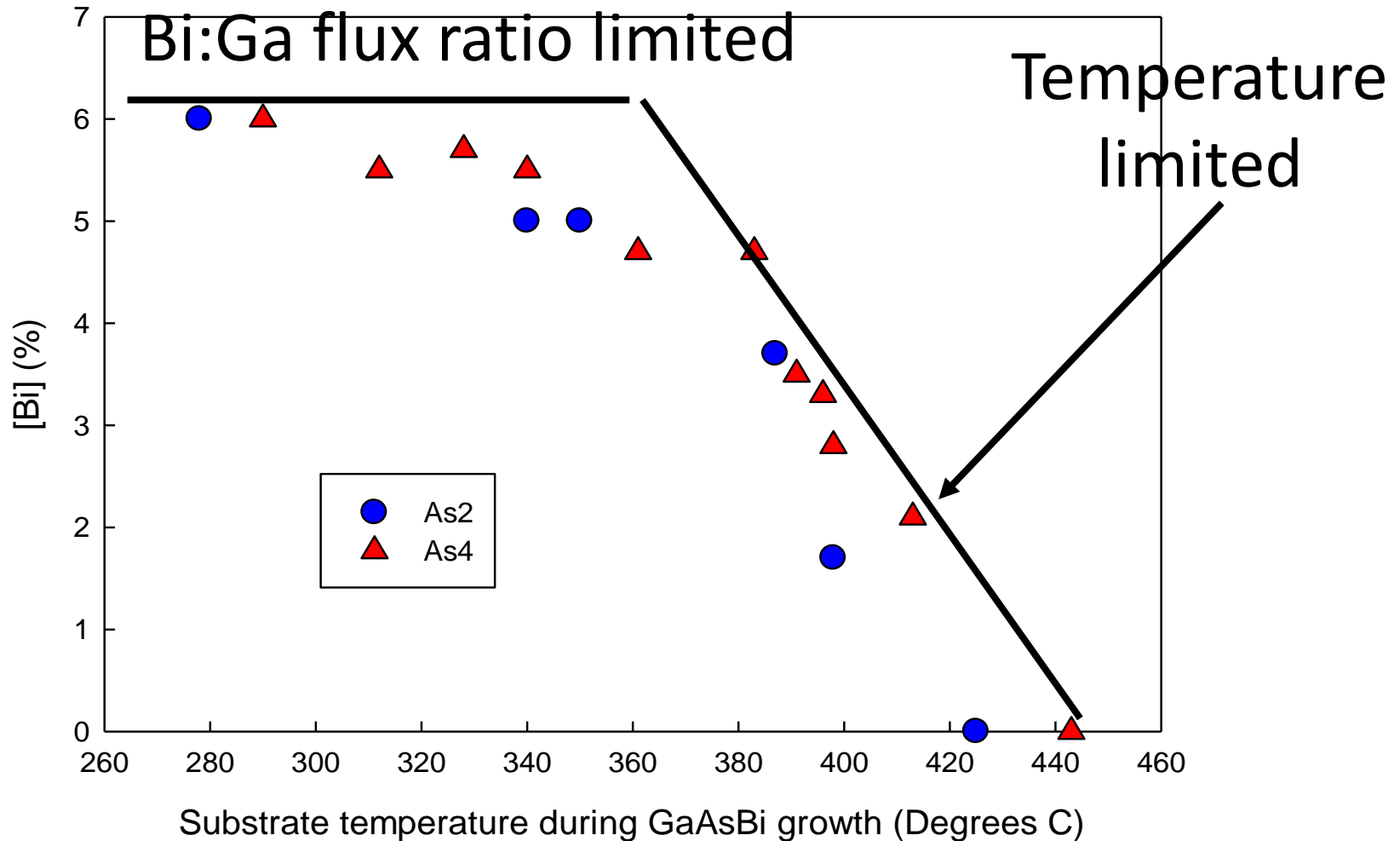
As₂ has a greater sticking coefficient than As₄.



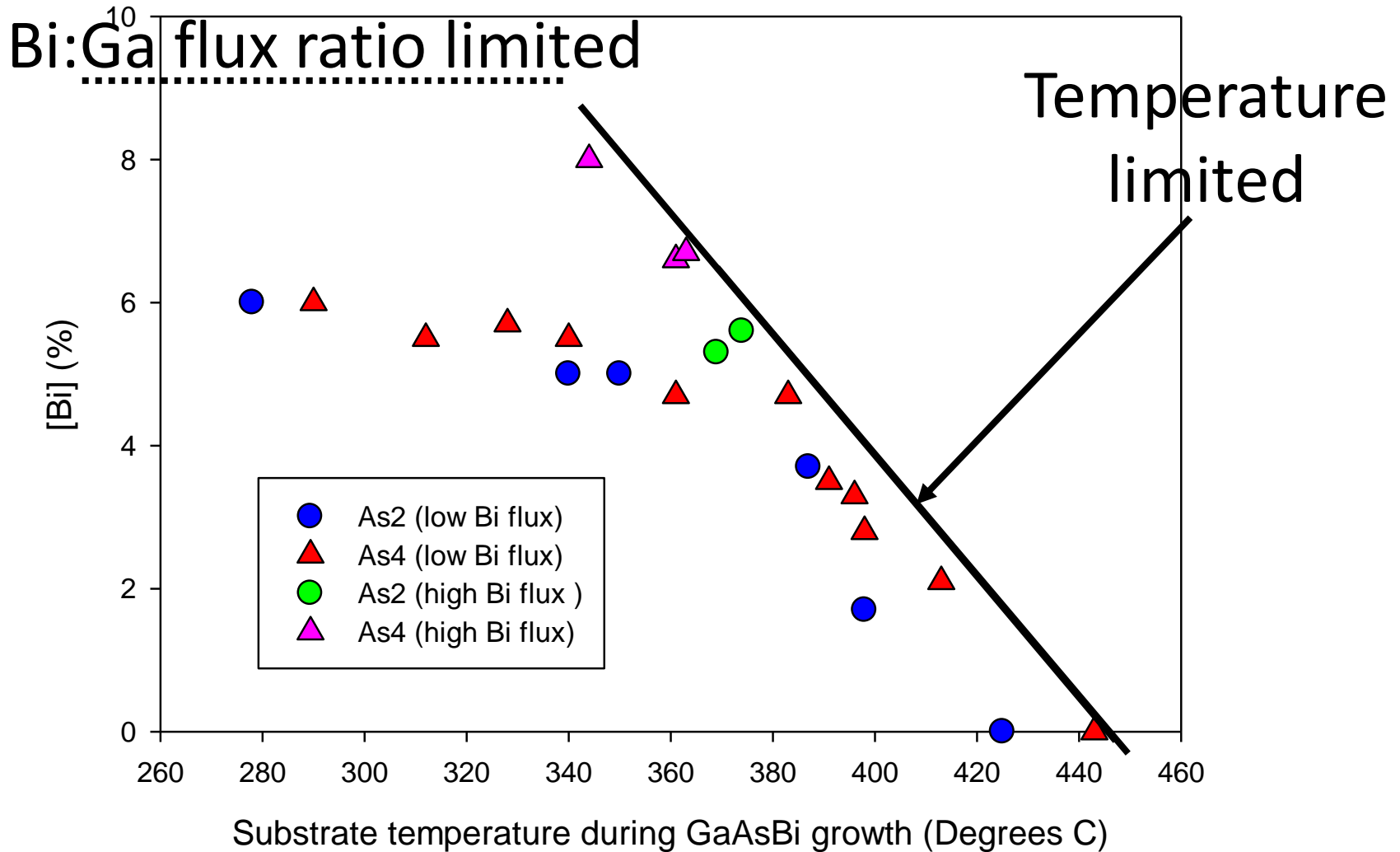
Foxon, C.T. and B.A. Joyce, *Interaction kinetics of As₄ and Ga on {100} GaAs surfaces using a modulated molecular beam technique*. Surface Science, 1975. **50**(2): p. 434-450.

Foxon, C.T. and B.A. Joyce, *Interaction kinetics of As₂ and Ga on {100} GaAs surfaces*. Surface Science, 1977. **64**(1): p. 293-304.

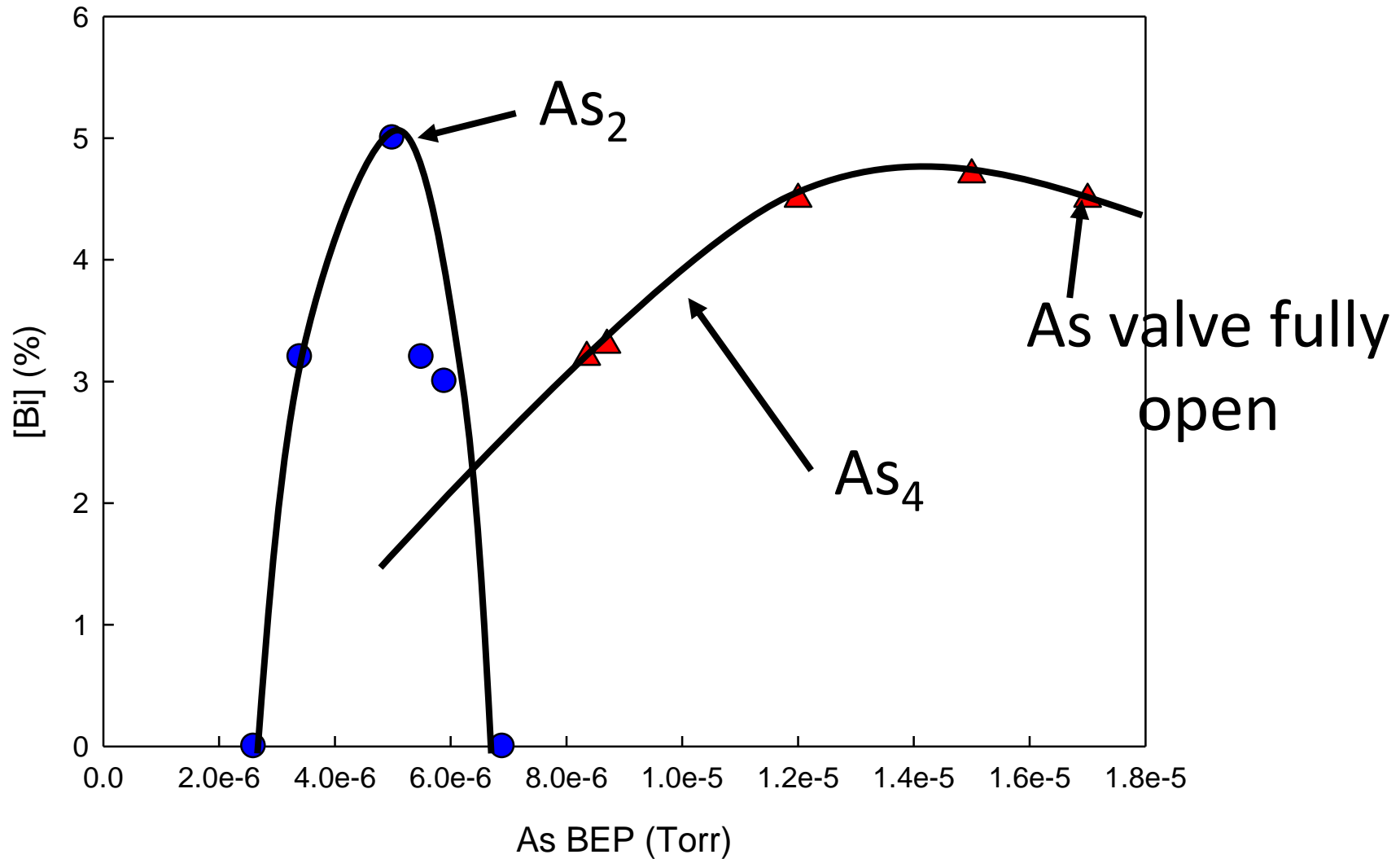
Temperature dependence



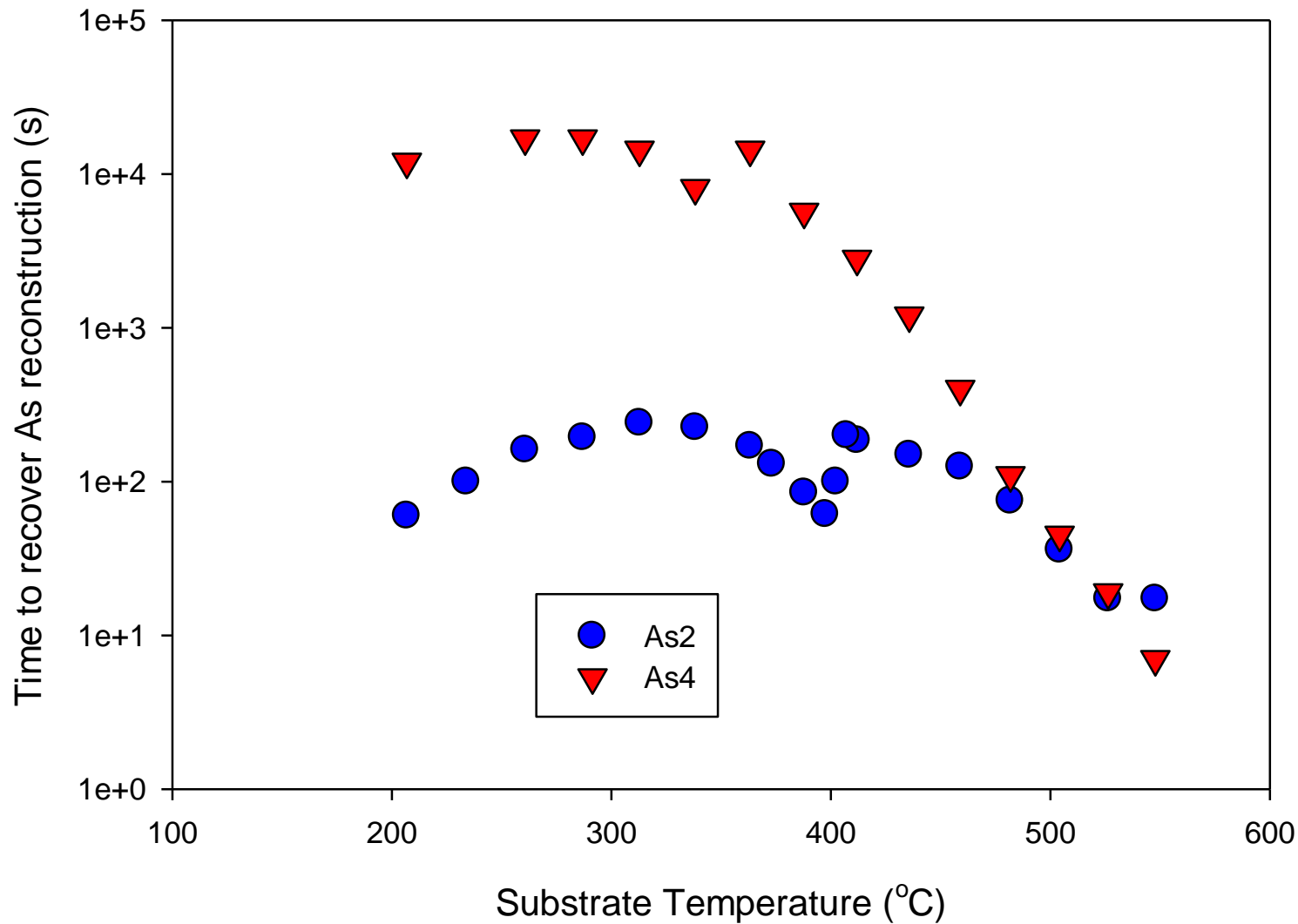
Bi flux dependence



As₂/As₄ flux dependence



As_{2/4} recovery times



Conclusions

[Bi] determined by substrate temperature,
Bi:Ga flux ratio and As:Ga flux ratio

Greater range of As_4 fluxes allow for
significant [Bi]

Probably due to Bi desorption by As_2 and
simpler surface kinetics with As_2



The
University
Of
Sheffield.



Any questions?

Robert Richards

R.Richards@sheffield.ac.uk



E-Futures