

A Transmission Electron Microscopy study of Fluorine implantation induced damage in Silicon

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Overview

- Motivation
- Experimental Methods
- Results and Discussion
 - Fluence dependence
 - Temperature dependence
 - Time dependence
- Conclusions

Results

Temperature dependence

Down-zone bright field XTEM analysis

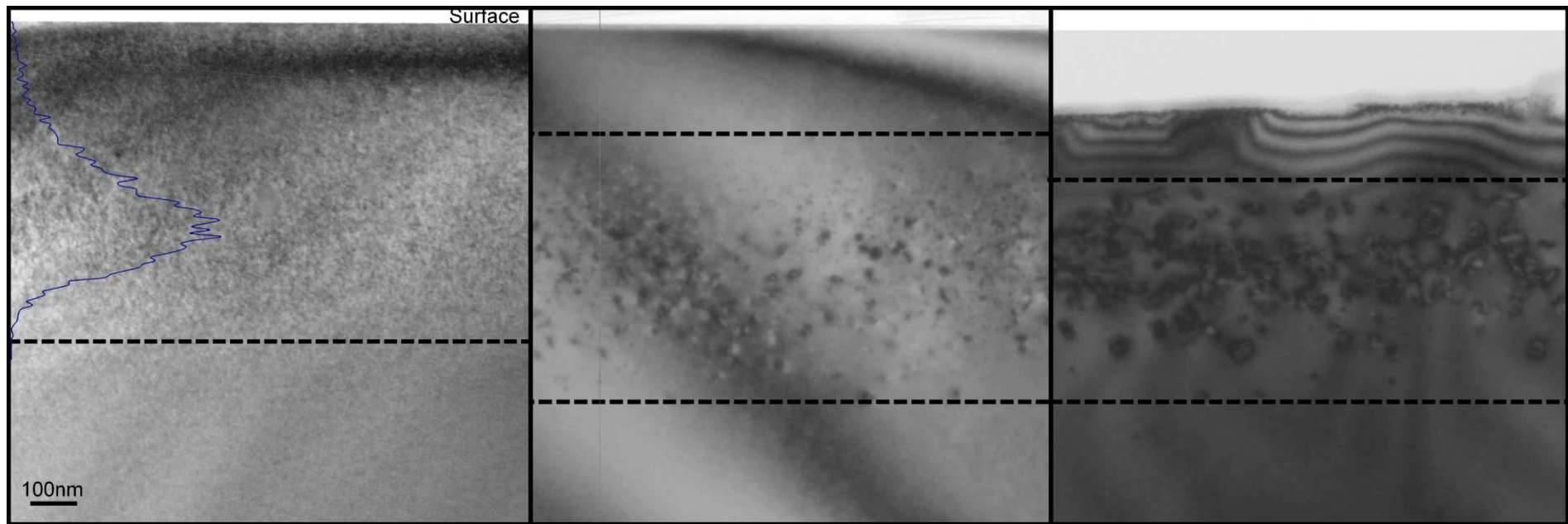
Damage overview

2.3×10^{15} F ions/cm²

As-implanted

RTA 800°C, 30s

RTA 900°C, 30s



700nm wide

235nm below surface
630nm wide

550nm wide

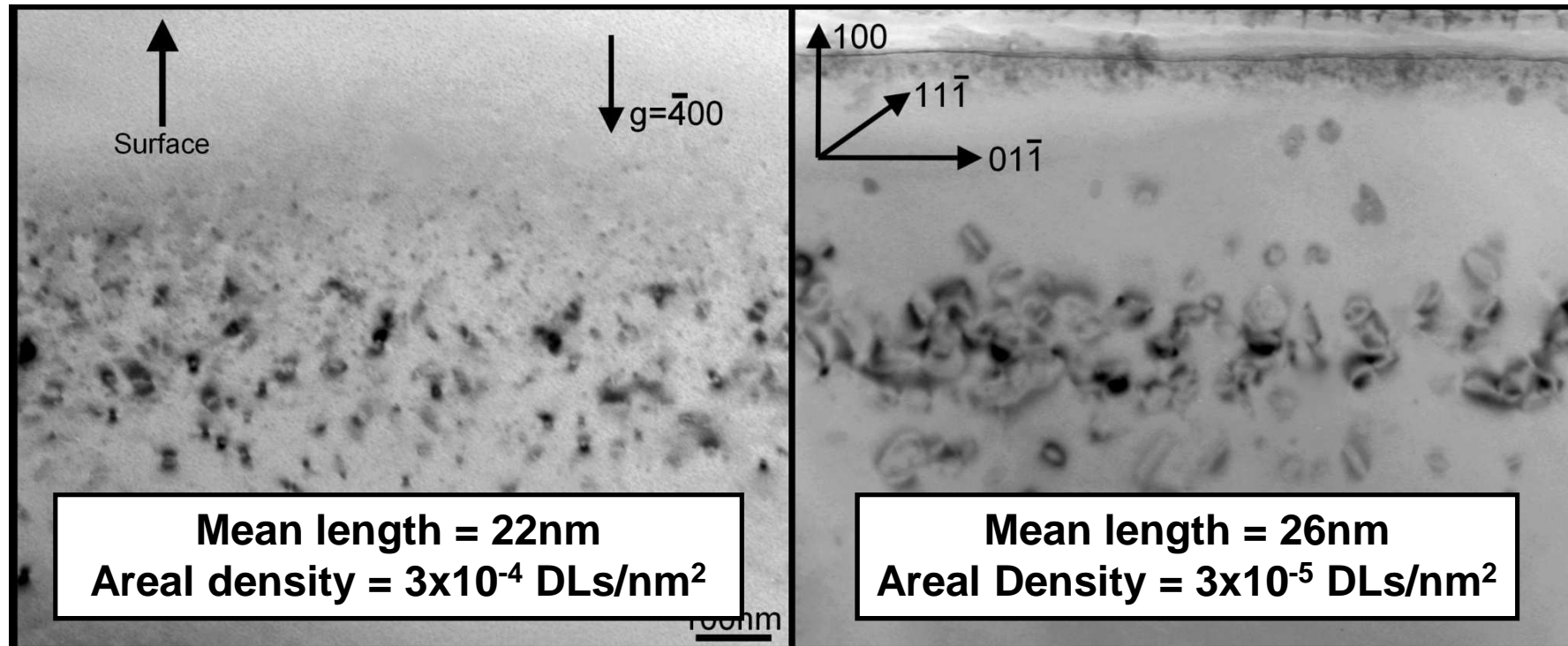
2-beam XTEM analysis

Dislocation loops

2.3×10^{15} F ions/cm²

RTA 800°C, 30s

RTA 900°C, 30s



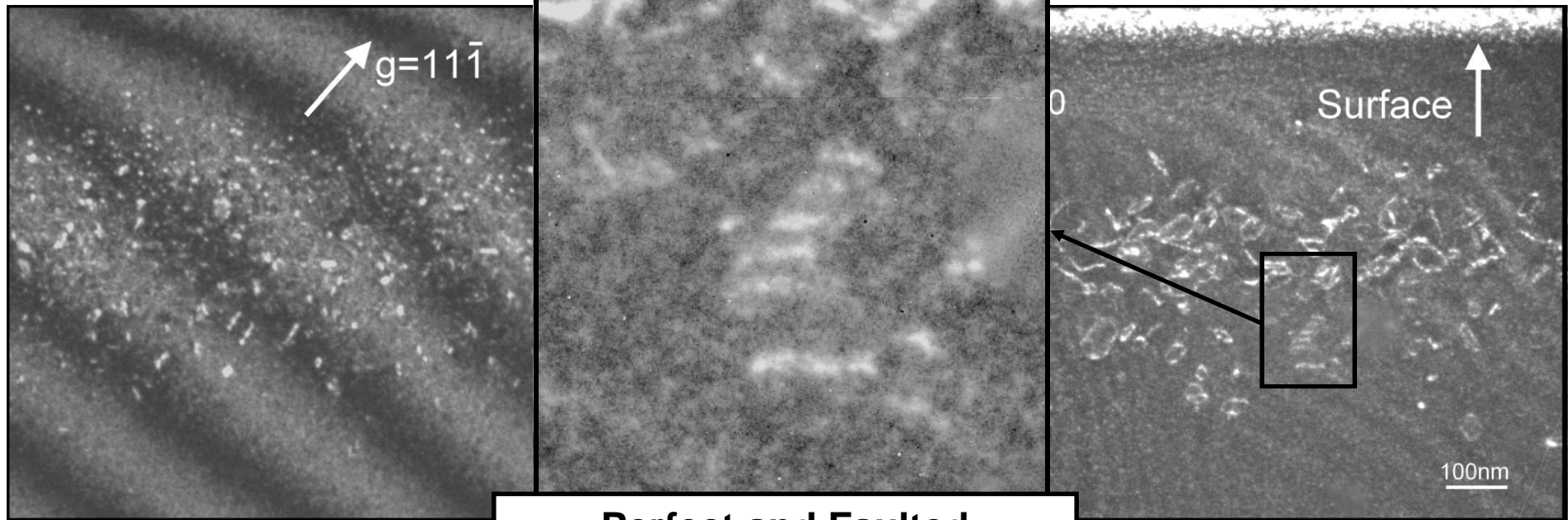
Weak-beam, dark-field XTEM analysis

Dislocation loops and {311} rod-like defects

2.3×10^{15} F ions/cm²

RTA 800°C, 30s

RTA 900°C, 30s



Dislocation loops and

Perfect and Faulted
Dislocation Loops

dislocation loops

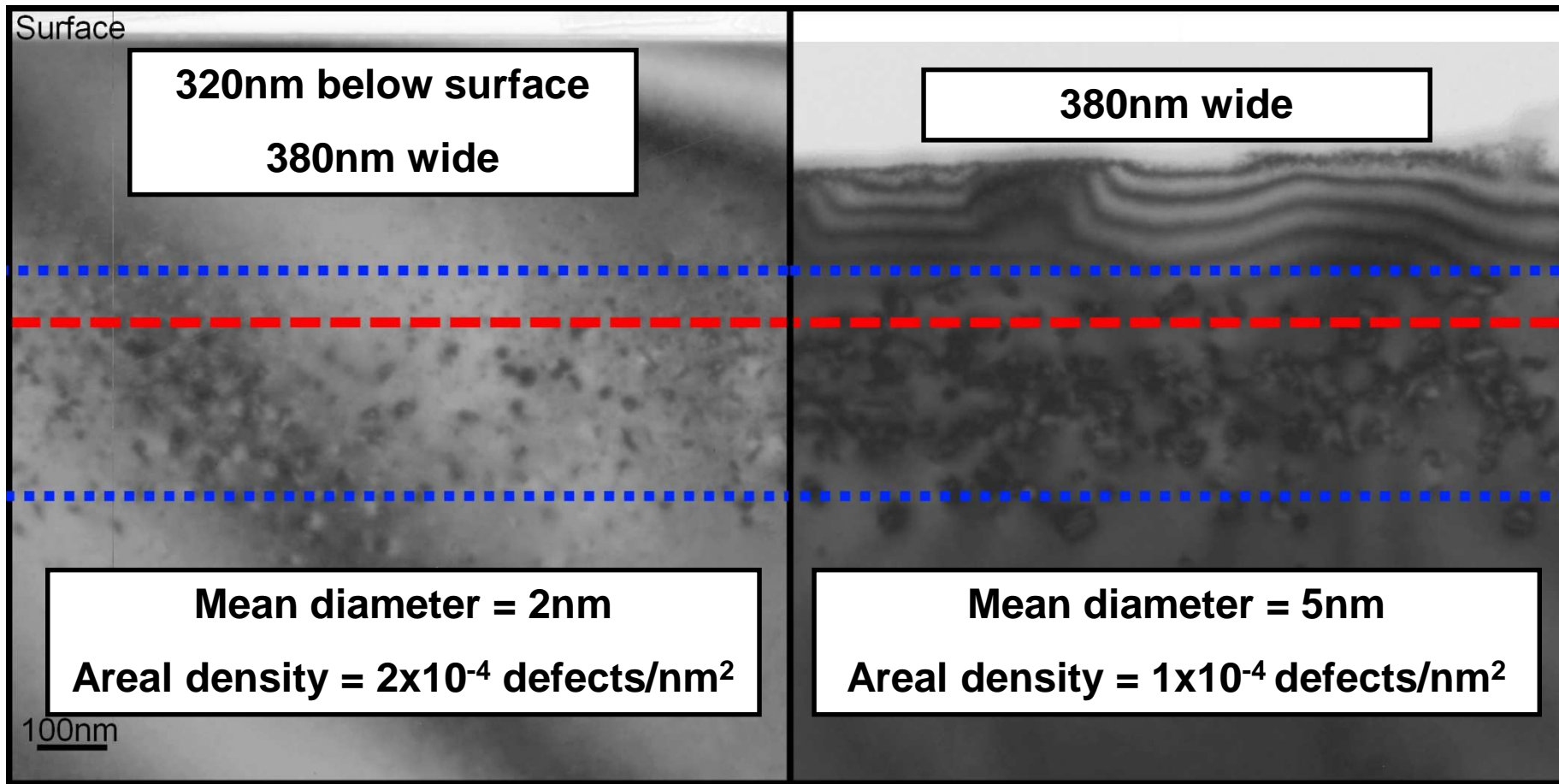
Fresnel contrast analysis

Vacancy-type defects

2.3×10^{15} F ions/cm²

RTA 800°C, 30s

RTA 900°C, 30s



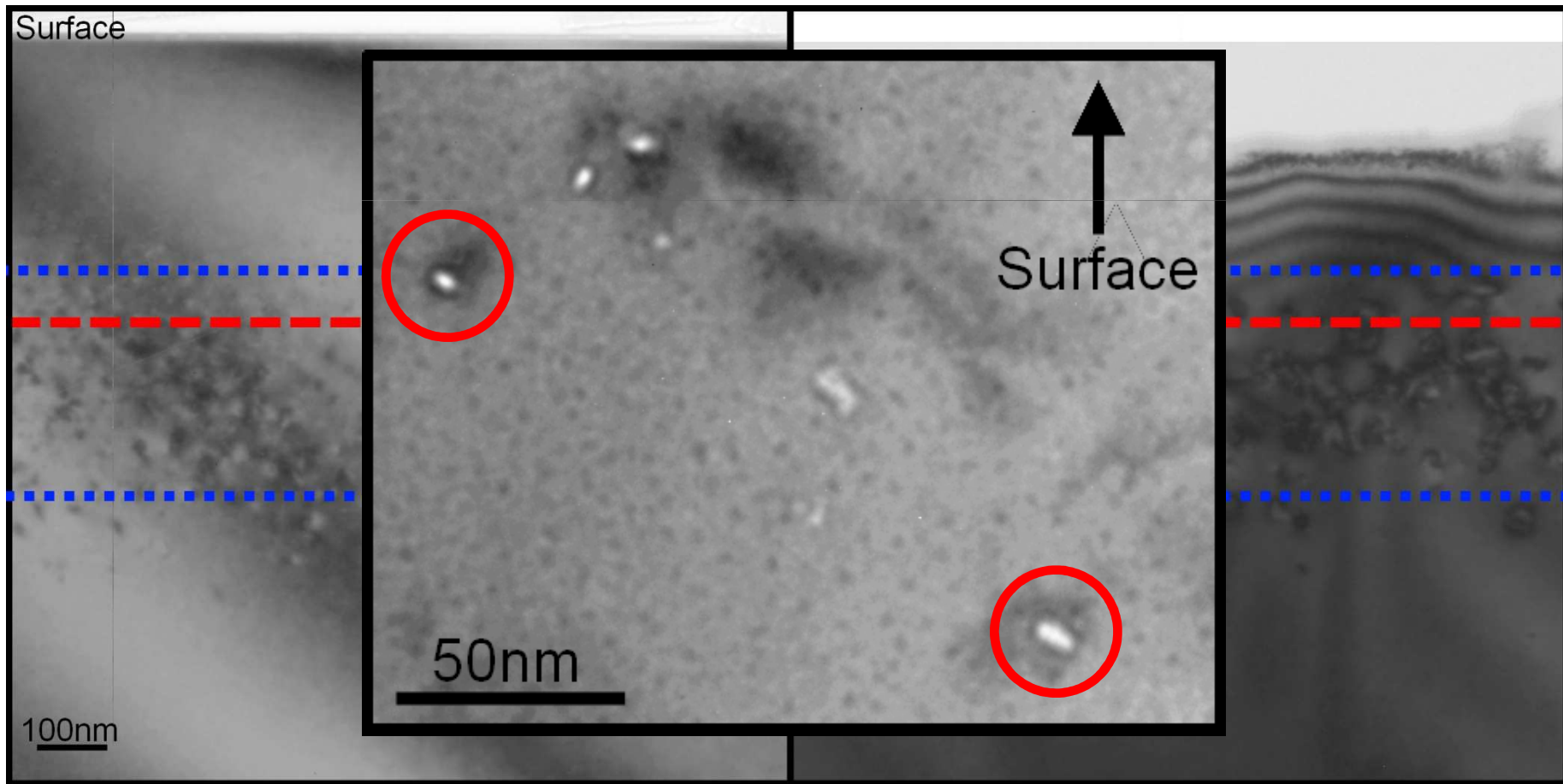
Fresnel contrast analysis

Vacancy-type defects

2.3×10^{15} F ions/cm²

RTA 800°C, 30s

RTA 900°C, 30s



Summary of temperature dependant results

1. Thermally mediated evolution of interstitial defects by Ostwald Ripening:

Clusters \rightarrow $\{311\}$ \rightarrow Perfect DL's \rightarrow Perfect and Faulted DL's

2. TEM resolvable v-type defect not present in as-implanted sample, but formed by annealing
3. Some v-type defects evolve into defects elongated along $\{111\}$ planes