Interface Mixing in Ni₃N/SiX Bilayers Induced by Swift Heavy Ions

Motivation

- Highly excited electronic system
- Energy transfer to lattice, vivid atomic motion
- Cylindrical molten zone along the ions path
- Energy dissipation, rapid solidification, "quenching"
- Defect-rich or amorphous track $\varnothing \approx 10 \text{ nm}$

Experiments

- (Reactive) magnetron sputtering onto substrate
- Ni₃N/SiO₂, Ni₃N/SiC
- Au 350 MeV, Xe 230 MeV, Kr 260 MeV, Ar 90 MeV

Results

- Threshold Effect $S_e$
- Concentration Profiles
- Diffusion Constant $k = \frac{\Delta \sigma^2}{\Phi}$
- Mixing effect of a single ion $D : 10^{-3} - 10^{-4} \text{ cm}^2/\text{s}$
- Interdiffusion in liquid state

Threshold and Experimental Thresholds

- $S_e$: Interfacial $S_{e} = \text{Ni}_3\text{N}/\text{SiO}_2$
- $S_{e}$: Ni₃N/SiC
- $S_{e}$: Ni₃N/Si

- Global Thermal Spike Model $k = \frac{(\sigma^2(\Phi) - \sigma^2(0))}{\Phi}$
- Developed for nuclear stopping regime, but failed