Copper nitride is a metastable material which results very attractive because of their presence of a N2+Ar atmosphere [5]. Polycrystalline N-rich Cu$_3$N films with a thickness of ~100 nm were deposited by DC-tetrode sputtering from a Cu target in the presence of a N$_2$+Ar atmosphere [5].

Some of the samples were irradiated with Cu at 42 MeV at different substrate temperatures (100 °C < T < 300 °C). Nitrogen depletion is monitored by means of IBA techniques (NRA and ERDA).

### N depletion: influence of stopping power ($S$)

The characterisation of N depletion as a function of stopping power allows determining the $S$ threshold for N depletion.

- **N-rich Cu$_3$N/Glass**
- **N-rich Cu$_3$N (33 at% N)**
- **Glass or Silicon substrate**
- **Pre-halo**

Three regions can be distinguished in the process of nitrogen escape:

- **Region I:** The N content is almost constant; the migration and N$_2$ formation might be hampered by N trapping
- **Region II:** High N sputtering rate which rapidly increase with rising $S$ ➔ N migration > N trapping
- **Region III:** No N depletion is observed ➔ The N content in the sample is almost exhausted

- **Yield strongly increases with Se beyond a threshold value of 3.5 KeV/nm**
- **$Y_{measured} \gg 0.16$ N/at for Cu@42 MeV (calculated with SRIM)**

### Conclusions

- A high N depletion yield has been observed at intermediates radiation fluence.
- The number of N sputtered atoms very strongly increases with rising the electronic stopping power.
- The N depletion has been demonstrated not to depend on substrate temperature during irradiation.
- A stopping power threshold of 3.5 KeV/nm is determines for N depletion. This results is very important since it can be extrapolated to other irradiation techniques such as laser.
- All the data point out that the N depletion mechanism has an electronic nature and the excitonic model might account for the experimental observations.

### References


Our present aims are:
- To elucidate the responsible mechanism for the nitrogen losses.
- To determine the stopping power threshold for N depletion.

### Experimental Description

Polycrystalline N-rich Cu$_3$N films with a thickness of ~100 nm were deposited by DC-tetrode sputtering from a Cu target in the presence of a N$_2$+Ar atmosphere.

- **Samples deposition: DC Triode Sputtering**
- **Ion beam modification and characterization**
- **N depletion: Influence of the substrate Temperature during Irradiation**

- **N-rich Cu$_3$N/Glass**
- **Region I:** The N content is almost constant; the migration and N$_2$ formation might be hampered by N trapping
- **Region II:** High N sputtering rate which rapidly increase with rising $S$ ➔ N migration > N trapping
- **Region III:** No N depletion is observed ➔ The N content in the sample is almost exhausted

- **Yield strongly increases with Se beyond a threshold value of 3.5 KeV/nm**
- **$Y_{measured} \gg 0.16$ N/at for Cu@42 MeV (calculated with SRIM)**

### Conclusions

- A high N depletion yield has been observed at intermediates radiation fluence.
- The number of N sputtered atoms very strongly increases with rising the electronic stopping power.
- The N depletion has been demonstrated not to depend on substrate temperature during irradiation.
- A stopping power threshold of 3.5 KeV/nm is determines for N depletion. This results is very important since it can be extrapolated to other irradiation techniques such as laser.
- All the data point out that the N depletion mechanism has an electronic nature and the excitonic model might account for the experimental observations.

### References