



Report sul Quantum Technology Thrust

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Materials focus area

- Under the SQMS Materials Focus Area, experts work on understanding and mitigating the key limiting mechanisms of coherence in superconducting radio-frequency cavities and qubits in the quantum regime. Researchers expect to achieve at least an order-of-magnitude improvement in current device coherence times in the quantum regime, which corresponds to a goal of up to tens of seconds in superconducting cavities and up to milliseconds in superconducting 2-D transmons.

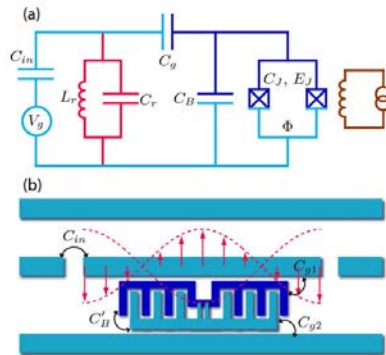
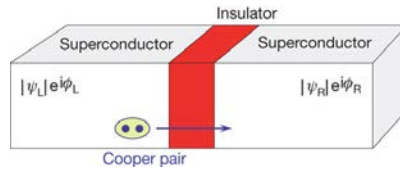


Rigetti Right Now

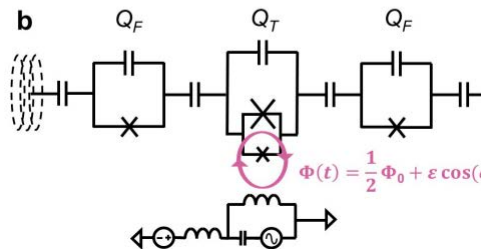
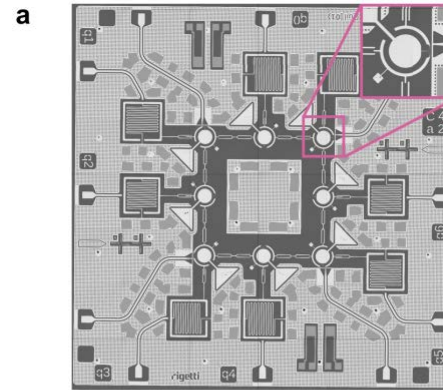
Aspen-9		Median Time Duration (μ s)	
Deployed	07.02.21	T1 Lifetime	30
Qubits	32	T2 Lifetime	17

Singolo qubit
~100-200 μ s

Transmission-line shunted plasma oscillation qubit



- Fluttuazione numero portatori nelle isole
- <https://arxiv.org/abs/cond-mat/0703002v2>



2017

5,5 mm x 5,5 mm

8 transmon qubit

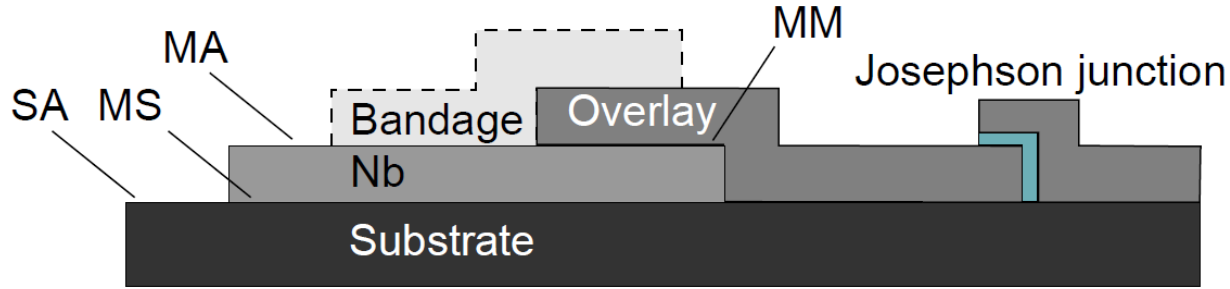
4 a frequenza fissa

4 operati a flusso variabile

Mitigazione cross talk

<https://arxiv.org/pdf/1706.06570.pdf>

Materials

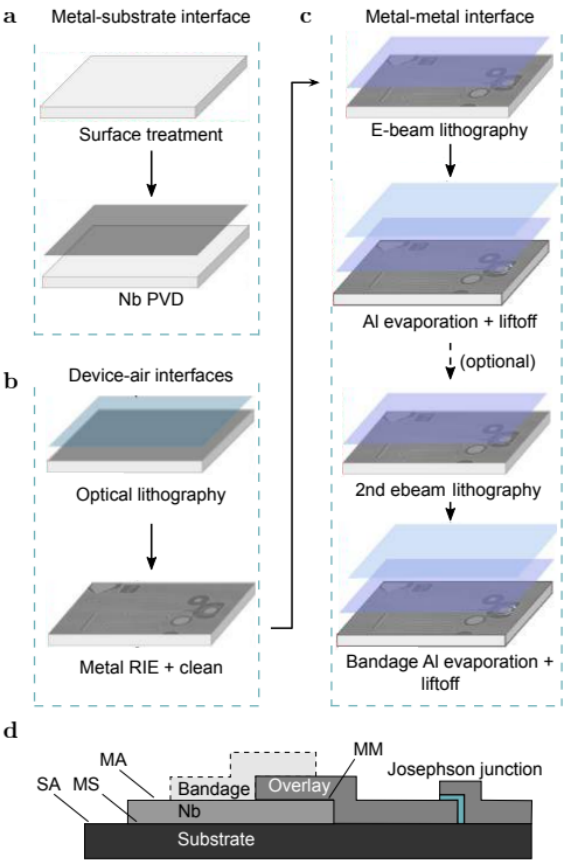


Fattori che limitano il tempo di coerenza

- Ottimizzazione delle interfacce
- Ottimizzazione dei materiali
- Ottimizzazione della geometria

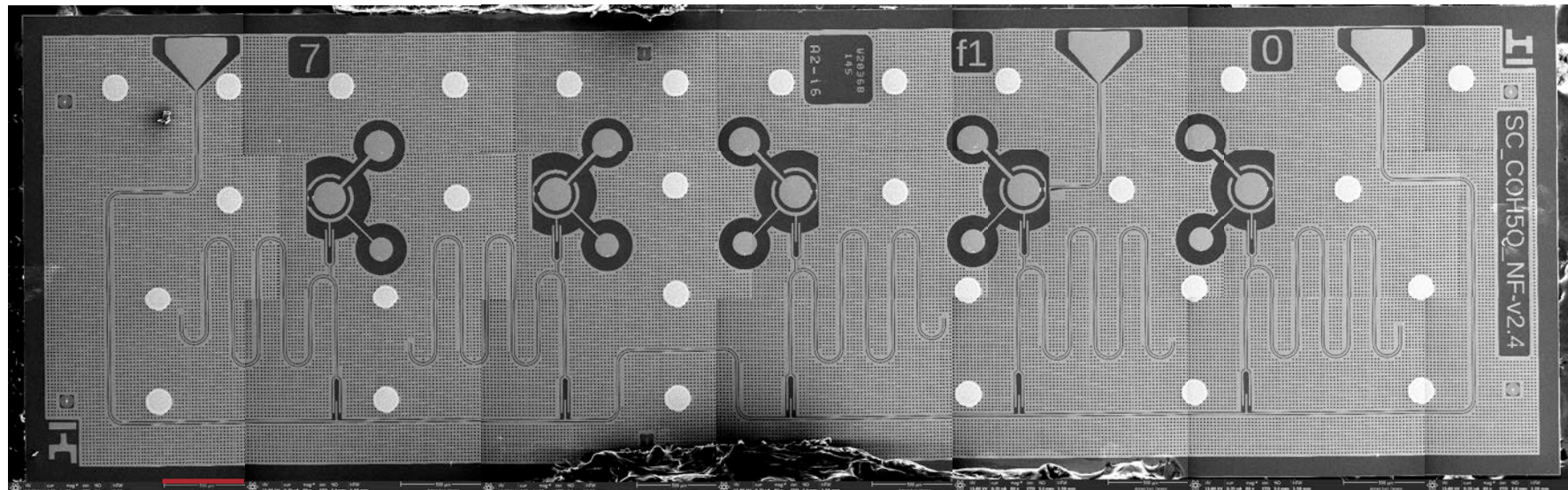
Studio a tappeto del dispositivo con ogni tecnica a disposizione

Fabbricazione



<https://arxiv.org/pdf/1901.08042v1.pdf>

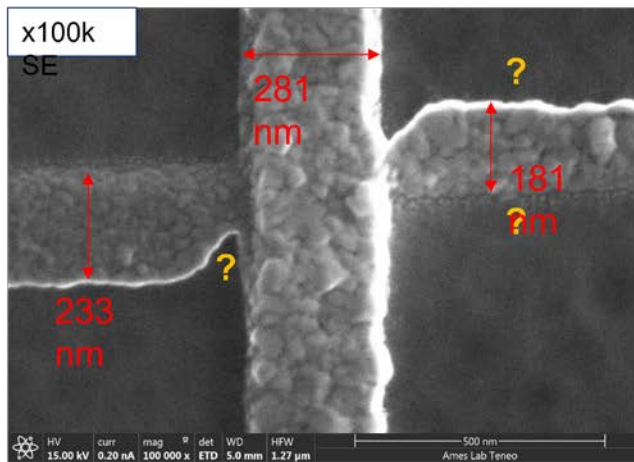
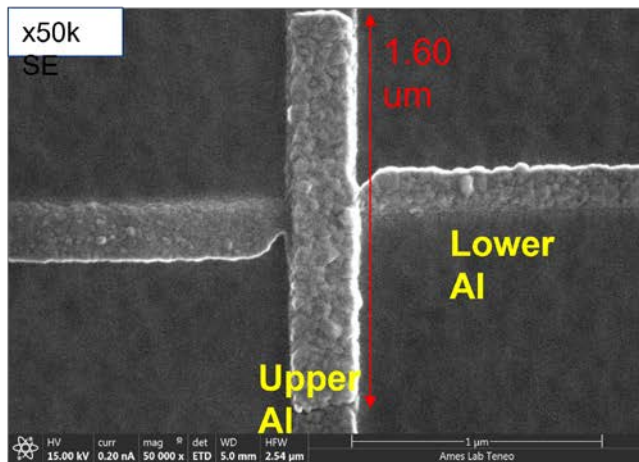
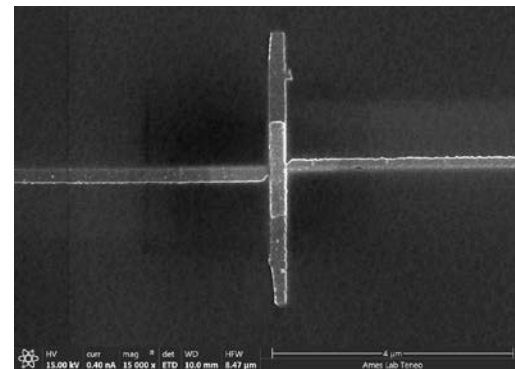
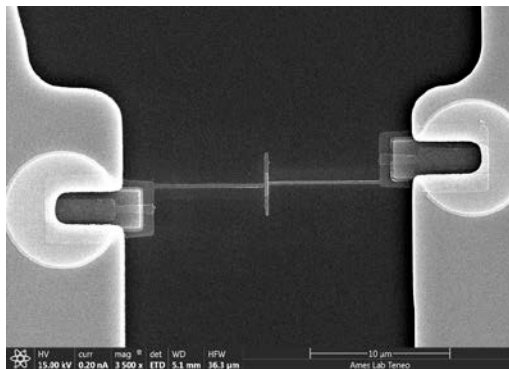
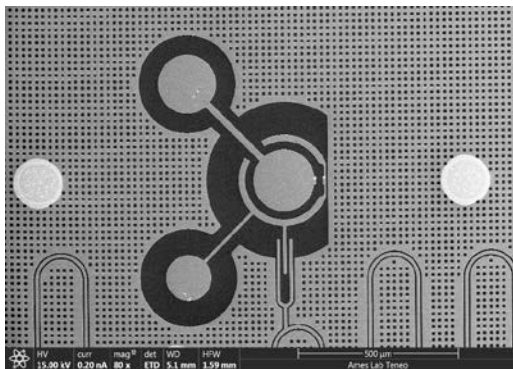
SEM immagine dispositivo completo



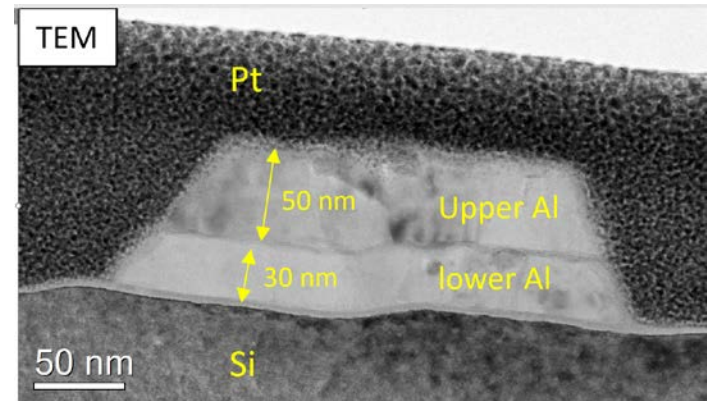
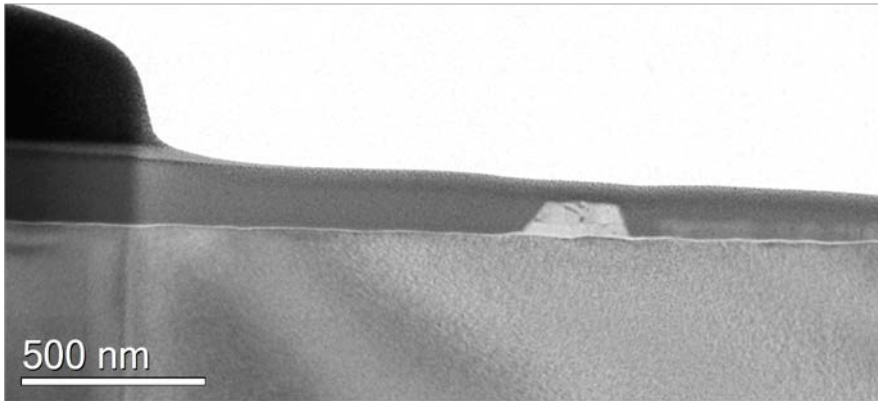
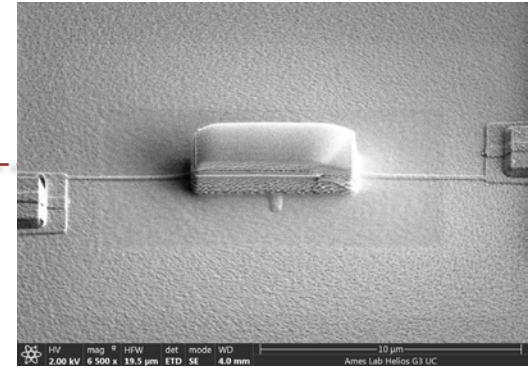
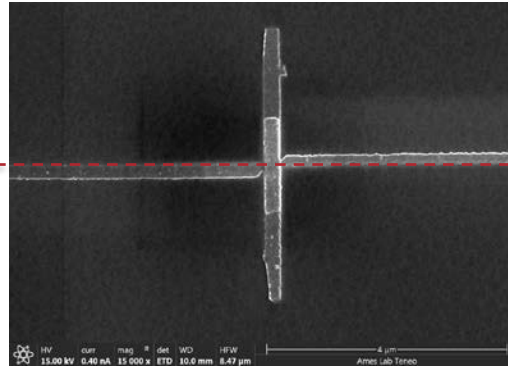
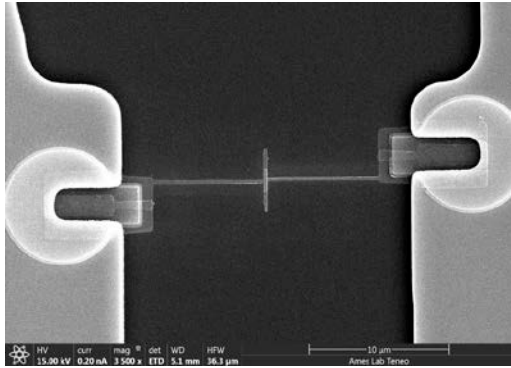
500 μm

Tae-Hoon Kim
Lin Zhou



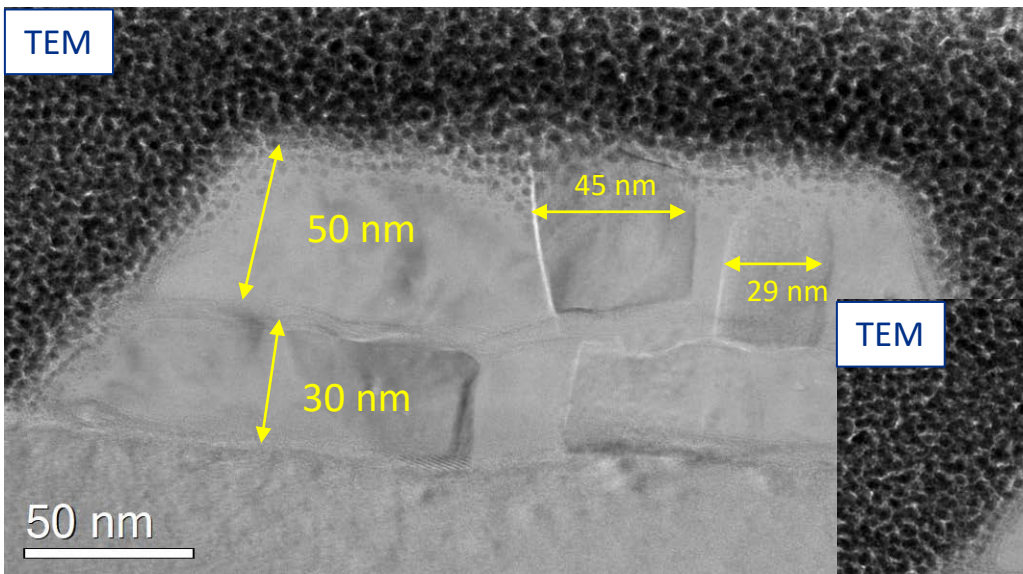


TEM giunzione

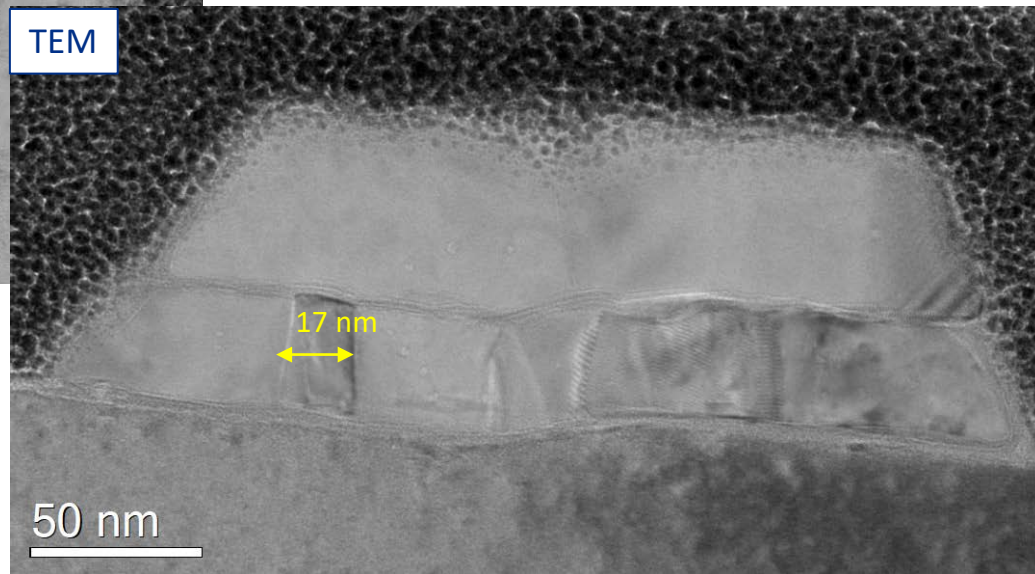


TEM giunzione

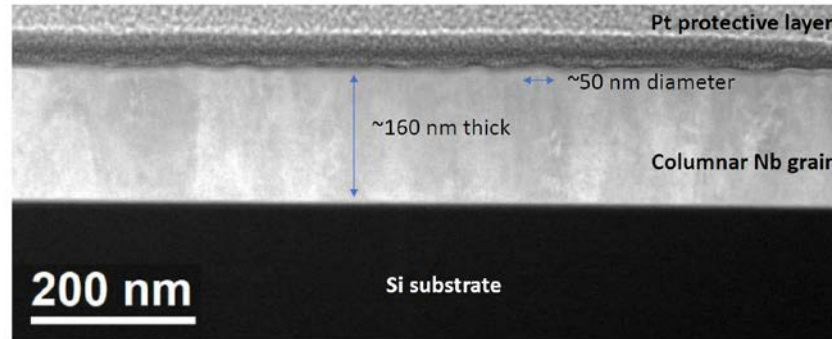
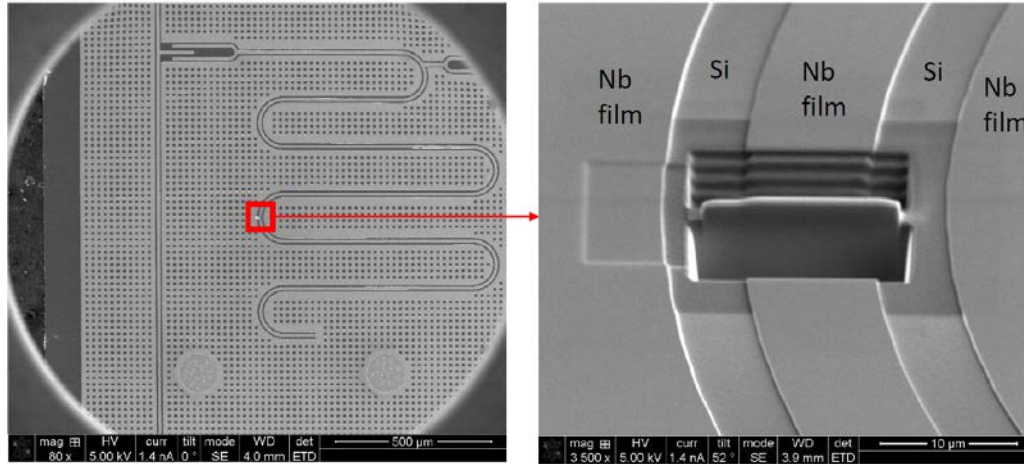
TEM



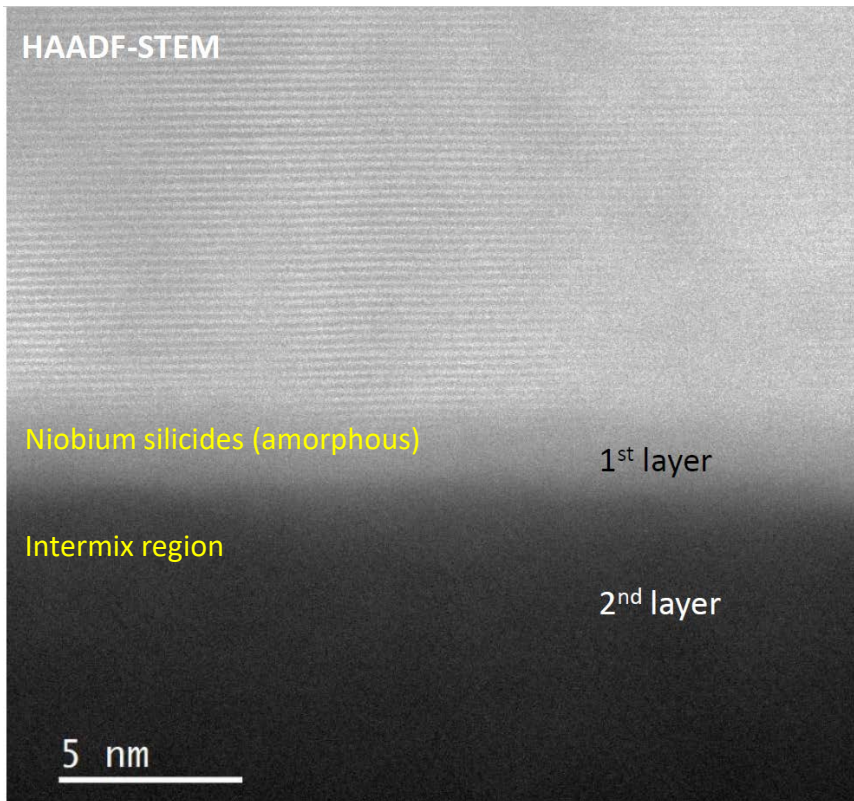
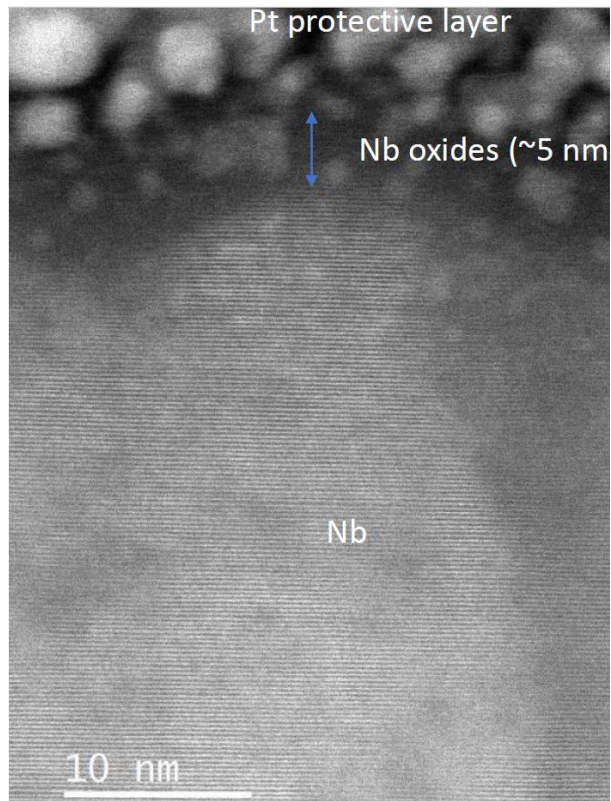
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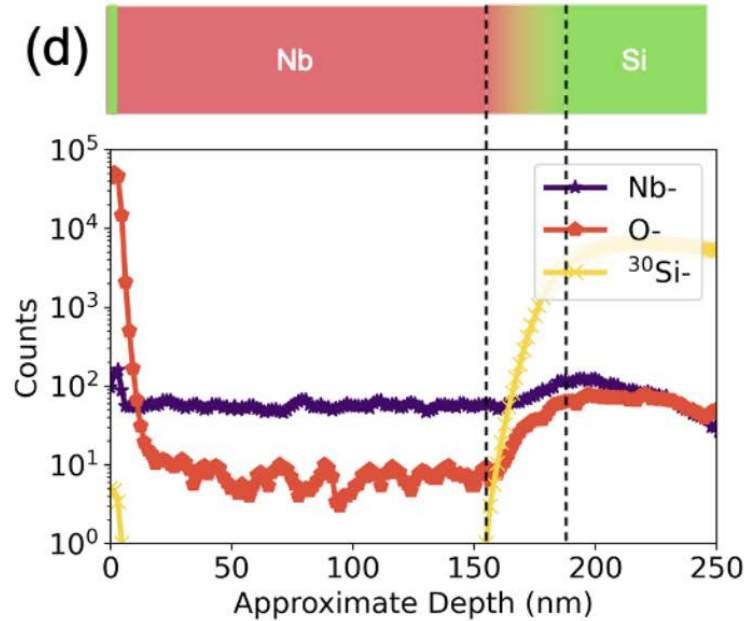
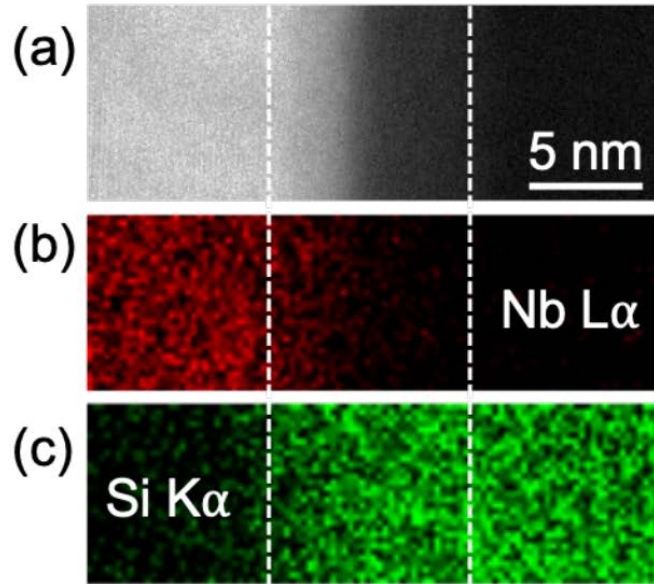
TEM interfaccia Nb/Si



TEM Nb



Nb/Si Analisi elementale



<https://arxiv.org/pdf/2108.13539v1.pdf>

Nb e composti

- Rimozione Nb₂O₅ con etching chimico 5 min BOE (5:1)
- Assorbimento, adsorbimento, diffusione H
- Composti idrogenati hanno effetto drammatico su Q
- Formazione cristalli precipitati a 1 K circa

Solution	pH
33% HF	1.0
2% HF	1.6
BOE (5:1) NH ₄ F:HF	3.8
NH ₄ F	7.0

