# Low-Loss Superconducting Ultra-Thin Film Heterostructures

Tech ID: 34137 / UC Case 2024-753-0

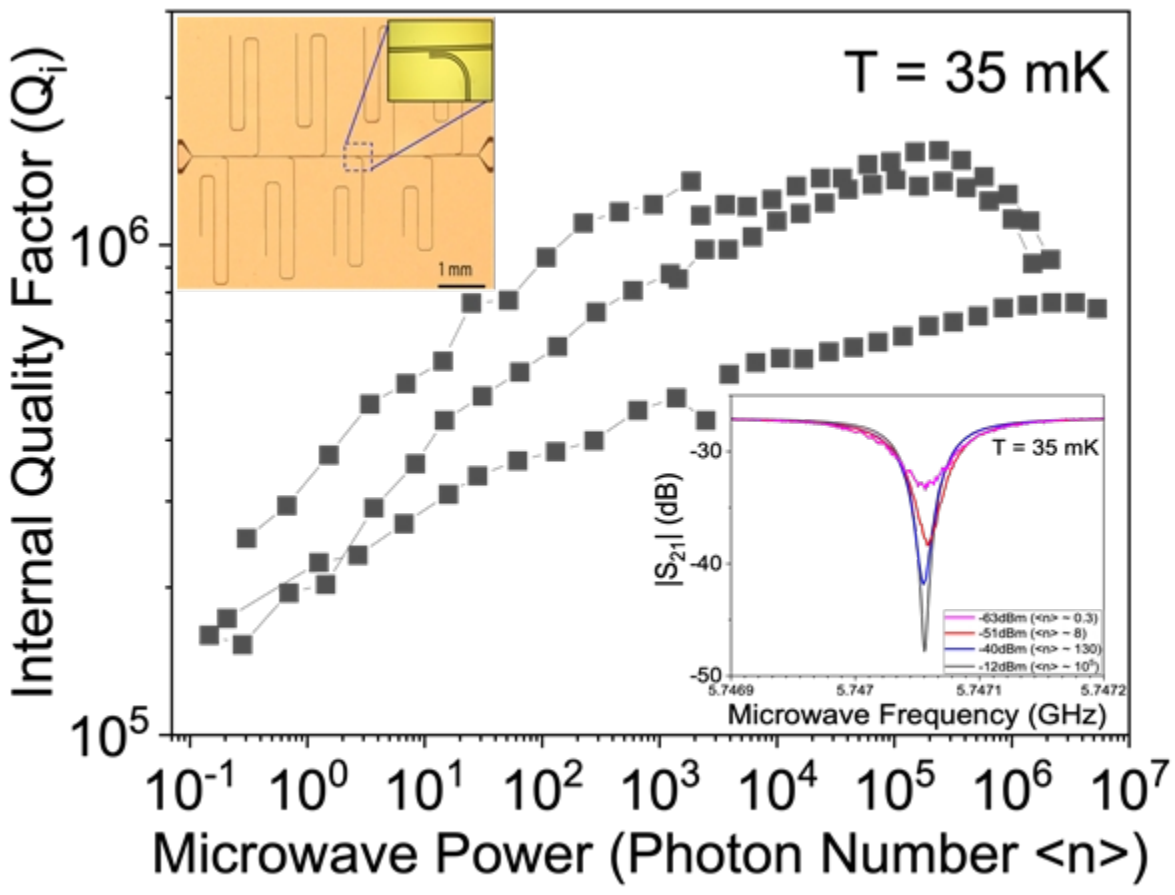
## FULL DESCRIPTION

### Background

The performance of today's superconducting circuits, particularly those used in quantum computing, is often limited by material defects and energy loss. Conventional superconducting materials degrade due to oxidation thereby compromising the quantum states and overall efficiency of the device. This creates a significant barrier in developing powerful and reliable quantum systems.

### Technology

Prof. Peng Wei and his team at UCR have developed a novel, material platform consisting of superconducting, ultra-thin film heterostructures designed for superior performance and longevity. The technology grows an ultra-thin, protective layer onto a base superconductor. The unique fabrication method creates a perfect and transparent interface between the layers. The resulting bilayer material is not only highly stable but can also be engineered to efficiently couple to low-loss surface plasmon resonance.




Q-factor for 3 typical quarter wave superconducting resonators

## ADVANTAGES

- Significantly reduces dielectric loss, leading to energy efficiency and enhanced quantum coherence.
- The protective layer prevents oxidation and degradation thereby increasing the reliability of the superconducting components.
- The process eliminates interfacial losses and inconsistencies found in conventional deposition methods.
- Uniquely designed to support low-loss plasmon resonance allowing for the development of novel quantum transducers.
- The material system allows for the creation of various high-performance components such as, resonators and interconnects.

## CONTACT

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## OTHER INFORMATION

### KEYWORDS

superconductor, quantum computing, plasmonics, low-loss materials, qubit, quantum transducer, resonator, high-coherence

### CATEGORIZED AS

- **Computer**
  - Hardware
- **Materials & Chemicals**
  - Superconductors
  - Thin Films
- **Semiconductors**
  - Materials

### RELATED CASES

2024-753-0

## APPLICATIONS

- Quantum computing - high-coherence qubits, resonators for low-loss quantum computers.
- Ultra-sensitive detectors and low-loss filters for next generation wireless and satellite communications.
- High-precision sensors for scientific and medical instrumentation.
- Devices that efficiently convert quantum information between microwave and optical frequencies.

## STATE OF DEVELOPMENT

- Proof-of-concept has been demonstrated, and device components have been fabricated and characterized at the lab scale

## INVENTOR INFORMATION

- Please visit Prof. Peng Wei's group website to learn more about their research
- Please read recent news coverage of Prof. Peng Wei at UCR

## RELATED MATERIALS

- Signatures of a spin-active interface and a locally enhanced Zeeman field in a superconductor-chiral material heterostructure

## PATENT STATUS

Patent Pending

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