

Experimental study of silver powder sintering for optimization of sintered heat exchanger in dilution refrigerator

Thursday 25 July 2024 14:00 (2 hours)

Abstract:

With the development of quantum computing and other scientific fields, dilution refrigerator, as a major ultra-low temperature refrigeration equipment, is required to greater cooling capacity. The silver powder sintered heat exchanger is an essential component of the dilution refrigerator, as it determines its minimum temperature. This study examines the sintering of silver nano powder samples with particle sizes of 50 nm, 100nm, and 200 nm, sintering pressures of 0.4 MPa, 0.7 MPa, and 1.0 MPa, and sintering temperatures of 220°C and 200°C. The porosity and specific surface area were measured, and the 200 nm silver powder was found to have the best performance under the conditions of 1.0 MPa and 220°C, with a specific surface area of 2.3m²/g. It was successfully applied to a dilution refrigerator and achieved a minimum temperature of 19 mK and a cooling capacity of 300 μW at 100 mk. This experiment will effectively improve the cooling capacity of the dilution refrigerator and provide guidance for the design of the dilution refrigerator.

Keywords: dilution refrigerator, silver powder sintered heat exchanger, ultra-low temperature, high cooling power

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Session Classification: Thu-Po-3.5

Track Classification: Tracks ICEC 29 Geneva 2024: ICEC 04: Cryogenic applications: cryocoolers