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Superconducting quantum interference devices made with normal metal and insulator barrier Josephson junctions in Y-Ba-Cu-O directly written with a focused helium beam ETHAN CHO, MENG MA, Univ of California - San Diego, CHUONG HUYNH, Carl Zeiss Microscopy LLC, KEVIN PRATT, DOUG PAULSON, Tristan Technologies Inc., VICTOR GLYANTSEV, Superconductor Technologies Inc., ROBERT DYNES, SHANE CYBART, Univ of California - San Diego — We will present electrical transport data for Y-Ba-Cu-O superconducting quantum interference devices (SQUIDs) with focused helium ion damage Josephson junctions. The junctions were directly written with a 30 keV focused helium ion beam, which locally creates disorder in Y-Ba-Cu-O that induces a superconducting-insulator transition. SQUIDs with Josephson junctions written with a dose of $4{\times}10^{16}$ He^+/cm^2 have metallic barriers and show a current-voltage characteristic (I-V) well-described by the resistively shunted junction model. The spectral density of the flux noise is 10 $\mu\Phi_0/\sqrt{Hz}$ at 10 Hz and the white noise at higher frequencies is 2 $\mu\Phi_0/\sqrt{Hz}$. SQUIDs with junctions written with higher ion doses ($\sim 9{\times}10^{16}$ He^+/cm^2) have insulating Josephson barriers with a critical current of 22 μA and a resistance of 12 Ω at 4 K. The I-V for all of these devices is not hysteretic due to the small capacitance and the resistance. At higher voltage the junction I-V curve shows tunnel-junction behavior and a superconducting energy gap edge at 20 mV. We will discuss how these results are a promising step forward for sensitive magnetic sensors made from high temperature superconductors at various temperatures.

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