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**Transition from superconducting-normal metal to superconducting-insulating barrier in focused helium beam YBCO Josephson junctions** ETHAN CHO, SHANE CYBART, Univ of California - San Diego, CHUONG HUYNH, Carl Zeiss Microscopy, LLC, ROBERT DYNES, Univ of California - San Diego — We report measurements of the metal–insulator transition (MIT) in high–transition–temperature–superconductor, planar Y–Ba–Cu–O Josephson junctions. The junctions were made by irradiation of a $\sim$1 nm barrier with a focused helium ion beam. To describe the MIT we use a theoretical model by Blonder, Tinkham and Klapwijk (BTK). This model explains transition of the transport at a superconducting normal metal/insulator interface using a single parameter, the barrier strength (Z). In our experiment, the dose of the $He^+$ ions serves the role of Z. We tested 20 junctions created using 20 different doses ranging from $10^{16}$ $He^+/cm^2$ to $10^{17}$ $He^+/cm^2$. We measured current–voltage characteristics of the junctions for several temperatures, and extract critical current ($I_C$), normal state resistance ($R_N$) and $I_C R_N$ from fits to the data. We show that the $R_N$ of the junctions show metallic behavior for lower doses and change continuously to insulating at higher doses. We have demonstrated precise control over the junction parameters with $He^+$ ion dose, which opens up an avenue for studying materials sensitive to disorder as well as reproducible production of Josephson junctions for application.

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