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The insulating state of quench-condensed ultrathin Be and its relationship to the magnetic-field-tuned superconductor-insulator transition WENHAO WU, ZUXIN YE, Texas A & M University — The temperature dependence of the resistance of quench-condensed ultrathin and highly insulating Be films displays an Arrhenius behavior indicative of the existence of an energy gap that is much larger than the superconducting gap energy measured in the superconducting films. A large high-field negative magnetoresisatnce is also observed in highly insulating films, suggesting a reduction of this gap energy by the magnetic field. With increasing film thickness, this gap energy decreases and, eventually, the insulating state gives way to superconductivity in a thickness-tuned insulator-to-superconductor transition. For superconducting films not far from the thickness-tuned transition, the application of a magnetic field leads to a sharp field-tuned superconductor-to-insulator transition and a negative magnetoresistance at high fields. These results, as well as other results from InOx and TiNx films, are used to discuss the relationship between the insulator-to-superconductor transition and the insulator-to-metal transition. It is suggested that sharp field-tuned superconductor-to-insulator transitions occur in films in which the insulator-to-superconductor transition precedes the insulator-to-metal transition as the film thickness is increased (the level of disorder is reduced). This work was supported by the NSF under the grant No. DMR-0606529.

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