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Density of States measurements of AlMn alloys with tunable superconducting gaps GALEN O'NEIL, NIST/CU, DAN SCHMIDT, NIST, NATHAN MILLER, NIST/CU, JOEL ULLOM, NIST, ANTHONY WILLIAMS, GERALD ARNOLD, STEVEN RUGGIERO, Notre Dame — Superconductors with tunable transition temperatures and energy gaps are useful for a variety of device applications. For instance, transition-edge μ-calorimeter sensors and electron-tunneling μ-refrigerators have been made based on Al with various levels of Mn doping. The transition temperature of AlMn can be continuously tuned from about $\sim 1.35\ K$ to below 10 mK by Mn concentrations up to several thousand ppm. Here, we present detailed measurements of the superconducting density of states of AlMn made with both normal metal-insulator-superconductor and superconductor-insulator-superconductor tunnel junctions. We compare the data to theoretical expectations for magnetic and non-magnetic impurities in superconductors. In particular we show that the density of states of AlMn is not gapless as we would expect from magnetic impurities. Rather, present evidence indicates that the density of states is essentially BCS-like with an increased Dynes parameter. The increased Dynes parameter corresponds to a broadened peak at the gap and an increase in subgap states. We discuss the implications of this behavior for tunnel junction devices with AlMn electrodes.

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