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Tunnelling measurements of Nb_3Sn break junctions below and above the superconducting critical temperature

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A well-known A-15 superconductor Nb_3Sn with critical temperature $T_c \approx 18$ K has been investigated by electron-tunneling spectroscopy using a break-junction technique. The conductance peaks exhibit BCS-like energy-gap features with the values 2Δ = 4- 6 meV at the temperature, T = 4. 2 K. In addition to these superconducting gap structures, reproducible humps were observed at biases ± 20 - 30 mV and ± 50 - 60 mV at 4.2 K. Such hump structures are complementary to coherent peaks at the superconducting-gap edges, which resemble the pseudogap phenomena manifested in high-T_c superconductors. These humps remain the only gap-like manifestations above T_c. Their possible origins are discussed with the emphasis on CDW (charge-density waves) formation, which should be accompanied by periodic lattice distortions and are related to the structural phase transition found many years ago in Nb_3Sn. The current-voltage characteristics often exhibit asymmetries, which probably originate from either a consequence of the normal metallic junction or the emerging vanishing symmetry of the junction conductance with CDWs in both electrodes.

Keywords: Tunneling; break junction; energy gap; A-15 compound