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Optimization of deposition parameters of Nb3Sn thin film on copper with and without buffer layer

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In this study, superconducting Nb3Sn films were synthesised on different substrate such as sapphire, diamond turned copper and polished Nb, by DC magnetron sputtering from a single stoichiometric alloy Nb3Sn target. The structural, morphological and superconducting properties of the films were investigated. The effect of different deposition and substrate was examined. The film properties are characterized by XRD, SEM, EDX, SIMS and XPS. The DC superconducting properties of the films deposited on sapphire are characterized by a four-point probe measurement and squid magnetometer down to cryogenic temperatures. The RF surface resistance and critical temperature of films deposited on copper was measured over a temperature range of 4–23 K using 8.7 GHz choke Nb cavity. As-deposited Nb3Sn films on sapphire had a superconducting critical temperature of 18.26 K for optimum deposition condition. For the films deposited on copper and niobium has Tc of 16.5 K to 17.5 K , the surface resistance for direct 2.5 μm thick Nb3Sn, on copper was 25μΩ, which increased by two orders of magnitude when deposited on buffer layer of 4 μm thick Nb.

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