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Development and characterisation of advanced coatings for high energy physics applications

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The Future Circular Collider (FCC) study develops the technologies for next generation high performance particle colliders and accelerating structures. It places high requirements on the performance of Superconducting Radio Frequency (SRF) cavities used to accelerate the particle beam. While niobium-coated copper cavities are being considered for FCC-ee, alternative superconducting materials are investigated in view of reducing considerably the energy consumption of such a large machine.
Nb3Sn, an A-15 intermetallic type II superconductor, is one of those potential candidates. However, due to its brittle nature, the only way to produce an Nb3Sn SRF cavity consists of elaborating it as a thin film using, for example, magnetron sputtering to coat copper-based cavities.
The latest developments at CERN on Nb3Sn films production by DC-Magnetron Sputtering (DC-MS) and bipolar High Power Impulse Magnetron Sputtering (HiPIMS) are presented, together with a comprehensive microstructural and mechanical characterisation of the films. Special attention is paid to the role of interlayers to avoid Cu diffusion during the high temperature reaction and to the influence of the deposition method and parameters on the film superconducting performance.

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Footnotes

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