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Study of multilayer thin-film structures in superconducting acceleration cavities

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Currently, 1.3 GHz Nb superconducting elliptical cavities have achieved accelerating gradients of Eacc ≈ 40 MV/m. In contrast, theoretical predictions suggest that accelerating cavities with multilayer thin-film structures on their inner surfaces might reach gradients of Eacc ≈ 100 MV/m. Such significant performance improvements would represent a major advancement not only in high-energy physics experiments, but also in industrial applications. Previous studies have confirmed the feasibility and effectiveness of forming multilayer thin films on flat samples. The next step is to develop film-deposition techniques suitable for the inner surfaces of cavities. In particular, developing specialized cathodes for sputtering alloy films is a key challenge. Therefore, simulations of sputtering are conducted to analyze the distribution and thickness of the resulting films for the cathode design. Furthermore, by exploring various experimental conditions, thin-film deposition tests will be carried out efficiently for evaluating the performance of multilayer structures. This presentation reports in detail on studies related to thin-film depositions inside superconducting accelerator cavities.

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Footnotes

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