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Successful Al₂O₃ coating of superconducting niobium cavities by thermal ALD

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Al₂O₃ is one of the potential insulator materials in the superconductor-insulator-superconductor (SIS) multi-layer coatings of superconducting radio-frequency (SRF) cavities for pushing their performance limits. We report on the successful coating of two 1.3 GHz Tesla- shaped SRF cavities with 18 nm and 36 nm layers of Al₂O₃ deposited by thermal atomic layer deposition (ALD). The coating recipe was developed by thermal atomic layer deposition (ALD). The coating recipe was optimized with respect to different the applied process parameters such as exposure and purge times, substrate temperature and flow rates. After a proof-of-principle Al₂O₃ coating of a cavity, second the cavity maintained its maximum achievable accelerating field of more than 40 MV/m and no deterioration was observed [1]. On the contrary, an improvement of the surface resistance above 10 MV/m has been observed, which is now further under investigation.

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Footnotes

[1] M. Wenskat et al., "Successful Al₂O₃ coating of superconducting niobium cavities with thermal ALD" 2022 Supercond. Sci. Technol. 2022, DOI: 10.1088/1361-6668/aca83f"

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