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Nb₃Sn growth in vapor diffusion: process design for large surface area coatings

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Following the recent progress made in the Nb₃Sn coatings on single-cell SRF cavities, development is ongoing to reproduce single-cell cavity results on practical SRF structures. Those structures may include multi-cell and single-cell cavities having a larger surface area than regularly coated ~1.5 GHz single-cell cavities. Early CEBAF five-cell cavities coated with a typical coating procedure resulted in high low-field quality factors, but strong low-field Q-slopes and early quenches typically limited the cavities. Followed by a material analysis of witness samples positioned in strategic locations during cavity coating, several changes from the original process design for single-cell cavity coating were introduced to improve the quality of Nb₃Sn films for large surface area coatings. The best Nb₃Sn-coated CEBAF 5-cell cavities have reached accelerating gradients useful for cryomodules. We will discuss process designs used to coat CEBAF five-cell cavities and a 952 MHz single-cell cavity at JLab.

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