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Doping optimization for ultra-high quality factor superconducting niobium cavities for particle acceleration ALEXANDER VOSTRIKOV, University of Chicago / Fermilab, ALEXANDER ROMANENKO, ANNA GRASSELLINO, Fermilab, YOUNG-KEE KIM, University of Chicago — Increasing quality factor of the fundamental mode in superconducting radio frequency (SRF) niobium cavities is vital for development of the future particle accelerator facilities, i.e. LCLS-II, Project X, ERLs, and ADS for nuclear energy and waste transmutation, since it directly affects the dissipated power in cavity walls. It has been discovered that doping of certain concentration of nitrogen into the surface of superconducting niobium significantly improves the quality factor of SRF cavities. We report the results of the nitrogen doping optimization guided by diffusion model and present two surface treatment procedures that allow achieving optimal value of nitrogen concentration at the surface of cavity: one with electropolishing required, another one without it.

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