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Progress in the Development of Superconducting RF

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The R&D of superconducting radiofrequency (SRF) cavities is focused on lowering the power dissipation, i.e. increasing the Q factor, during their operation in accelerators. Nitrogen doping is the innovative high Q SRF technology currently implemented in the LCLS-II cavity production. Of crucial importance is the understanding on how high Q factors can be maintained from the cavity vertical test to the cryomodule operation. One of the major issue of SRF cavity operation is the remnant magnetic field which will always be present during the cool down through the critical temperature, jeopardizing the cavity performance. Research is ongoing both to reduce the remnant field levels and to avoid magnetic field trapping during the SC transition. In addition, fundamental studies allowed us to define the best nitrogen doping treatment needed to lower the sensitivity to trapped flux. Recent developments on the preparation of Nb₃Sn coatings for SRF cavities will be also presented. This alternative technology has been demonstrated to allow high Q operation even at 4.2 K. In addition, the maximum field limit of Nb₃Sn is predicted to be twice that of niobium, potentially providing a significant decrease in the required length of an accelerator to reach a given energy.