Resume: In the paper is theoretically investigated the influence of the irradiation, arising during the work of SRF accelerators, on current carrying phenomena in HTc multilayered superconductors. The influence of the size and concentration of created then nano-defects, as well as physical parameters such as magnetic field and temperature, on the current-voltage characteristics and critical current of the multilayered HTc superconductors has been considered. It has been performed in details analysis of the interaction of the magnetic layered pancake type vortices with nano-sized defects, for various strengths of capturing. The comparison of the model with experimental data is performed, indicating good agreement. The electromagnetic, dynamic losses depend on critical current, generated in the superconducting current leads to the electromagnets for linearly time varying transport current, have been considered then. The detailed analysis of the dynamic magnetic induction distribution inside superconductor during varying current is therefore given, while Joule losses estimated too. As the result it has been established then the hysteretical behaviour of the total losses. It means that changes of the dynamic losses have been observed for the first and following current increase, which effect should have the meaning during multiply charging of the superconducting electromagnets.

\[
\Delta U(i) = \frac{\mu_0 I_c^2}{2}\left(-\arcsin(i) + \arcsin\left(\frac{d}{2}\right) + \frac{d}{2}\sqrt{1 - \left(\frac{d}{2}\right)^2} - \frac{1}{\sqrt{1 - i^2}}\right)
\]

Influence of the elasticity parameter \(\alpha_c\) on I-V curves of HTc for: (1) \(\alpha_c = 25 \times 10^4 [J/m^2]\), (2) \(\alpha_c = 20 \times 10^4 [J/m^2]\), at \(B = 1[T], T = 20[K]\)

Dynamic I-V curves of HTs dependent on critical current and induction sweep rate

Dependence of critical current versus defects concentration as the function of the nano-meter defects size: (1) 3 nm, (2) 2 nm, (3) 1 nm.

\[
L_{11} = -\frac{\mu_0 I_c}{4\pi} \ln\left(1 - \frac{I}{I_c}\right)
\]

\[
L_{2...n, I}(R) = \frac{\mu_0 I_c}{8\pi} \ln\left(\frac{I_m}{2(I_c - I)}\right)
\]

Expressions for the losses generated in the first and subsequent linear rises of electric current \(I = 1\) at, up to maximal value \(I_m\). \(I_c\) is critical current.