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## Nanowires as a model structure for diffusion experiments

One of the problems arising with linear accelerators such as CLIC [1] is the breakdown phenomenon [2] causing damage to the accelerating structures and disturbances in the accelerated beam. The cause of the vacuum breakdowns is still under investigation and the electrodes are regularly investigated for clues. One possible explanation for the cause of breakdowns is the hypothesis stating the formation of nanoprotusions in the electrodes. These protrusions can enhance the local electric field, being a possible cause of breakdowns, but up to this point protrusions on the electrode surfaces have not been observed.

To study the possibility of metal tip formation by atom diffusion, nanowires (NW) can be used as model structures. Metal NWs, either Cu, Ag or Au, can be heated up to observe diffusion processes. Heating in different configurations and environments with varying heating times and applied temperatures results in restructuring of the NWs [3-5]. Restructuring occurs at temperatures much lower than the melting temperatures of the metals being studied mostly resulting in spherical particles.

[1] Compact Linear Collider (CLIC), last accessed 08 Sep 2023, URL: <http://clic.cern/>

[2] A. Palaia et al. "Effects of rf breakdown on the beam in the Compact Linear Collider prototype accelerator structure", Physical Review Special Topics - Accelerators and Beams, 16, 8 (2013) 081004. 10.1103/PhysRevSTAB.16.081004

[3] S. Vigonski et al. "Au nanowire junction breakup through surface atom diffusion", Nanotechnology, 29, (2018), 015704

[4] B. Polyakov et al. "Comparison of the resistivities of nanostructured films made from silver, copper-silver and copper nanoparticle and nanowire suspensions" Thin Solid Films, 784, (2023), 140087

[5] E. Damerchi et al. "Heat-induced morphological changes in silver nanowires deposited on a patterned silicon substrate" Beilstein Journal of Nanotechnology, 15, Pages 435 –446 (2024)

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