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Surface quality and improvements on the SRF cavity manufacturing by electrohydraulic forming

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In the framework of the FCC study, niobium-coated copper cavities are considered to operate at 400 MHz. Electrohydraulic forming (EHF) is a potential alternative to conventional shaping methods of copper half cells, through which geometrical precision, a good repeatability and a reduced spring back can be achieved.

Material characterisation by hardness measurements, Electron Backscatter Diffraction (EBSD), Focused Ion Beam (FIB) and Scanning Transmission Electron Microscope (STEM) allowed to assess the forming effect of EHF. Results are compared with conventional spinning and some differences are found: improved roughness, a more uniform dislocation distribution, a homogeneous microstructure with no gradient in grain size and a non-perceptible affected layer are shown in the first tens of micrometers of the EHF samples.

Improvements to the process have been implemented: a new configuration of the EHF electrodes, water filtering to avoid ferromagnetic particles observed in the water after shaping during first trials.

Numerical simulations were performed to optimise the thickness at the iris, and enhanced results were obtained starting from copper discs of 3.4mm. An improved tooling was designed for machining the extremities.

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