# Growth of single domains through an array of holes for FCL c-axis superconducting elements

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***Abstract—***

Following the development of a resistive fault current limiter (European project Byfault), a more compact design has been proposed where the current flows along the c-axis instead of the (a,b) planes. The higher resistivity along the c-axis allows to reduce the required length of the material (electrical field up to 4000 V/m in c-axis, instead of 100 V/m in the (a,b) planes).
The oxygen annealing step of the samples is the key factor for developing the necessary superconducting properties. Usually an intense cracking along the ab plane is observed due to the mechanical constraints introduced during the oxygen uptake. An annealing treatment has been designed to reduce drastically the cracking. However, this treatment can only be applied to samples with thickness lower than 1.5 mm.
To simplify manufacturing and increase reproducibility, single domains (Ø2 and 4cm) were grown by the TSMG method through a triangular array of equidistant holes. Holes as small as 0.8 mm in diameter and distant of 2 mm were drilled parallel to the c-axis in YBaCuO sintered pellets in order to produce a geometry with walls having a thickness less than 1.5 mm. We have observed that the growth proceeds similarly to a plain pellet. The holes remain open. The growth front is slightly distorted by the holes, but reaches the edges. The growth of a single domain is confirmed by microscopic observation under polarized light as well as by flux mapping experiment. An indirect advantage of this geometry is the disappearance of the porosity usually trapped within a plain single domain. Further investigations are under way to confirm the interest of such geometry for the material quality, the oxygen annealing and the application.

***Keywords—*** shaping, grain growth, oxide superconductors, single domain, functional applications**.**