ESRF	**Experiment title:** Local concentration of Bi-2212 in superconducting Bi-2223 filaments	**Experiment number**: HE-1579
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Report:

The critical current density (J_c) of state of the art Ag/Bi-2223 superconducting tapes is ~40 kA/cm^2, but this is a factor of 10-20 below the local values found by magneto-optical current reconstructions and in thin films. The production of these tapes, by the powder in tube method, involves various heat treatments and rolling steps. The resulting defects, such as cracks, grain boundaries, and second phases impose serious limits on the current-carrying cross-section, thus reducing the overall J_c to 10-20% of the local J_c.
An interesting result is that magnetisation studies have revealed a kink in the temperature dependence of the susceptibility near 80K, close to T_c of Bi-2212. The size of this kink is a measure of the residual Bi-2212 concentration, and is closely correlated with the J_c of the superconductor: a high Bi-2212 concentration correlating to lower J_c. This Bi-2212 is a sign of incomplete reaction to Bi-2223 and is so far a characteristic of all Bi-2223 tapes, even the very best. However, these experiments provide only qualitative information about the amount of Bi-2212 still present in the tape.

The main goal of the experiment is to extract quantitative information on the local amount of Bi-2212 and its exact locations within the filaments by an X-ray diffraction technique. Because the regions in which a high or a low Bi-2212 is expected are only in the size of 20x20 μm^2, a very small X-ray beam of 1.5x13.5 μm^2 is used in the experiment. Simultaneously with the diffraction experiment, a fluorescence experiment has been performed.

We have investigated 5 regions of 100x100 μm^2 in 3 different samples. These samples were extracted from different parts of the tape. The regions were selected from the central part of a filament and from the edge.

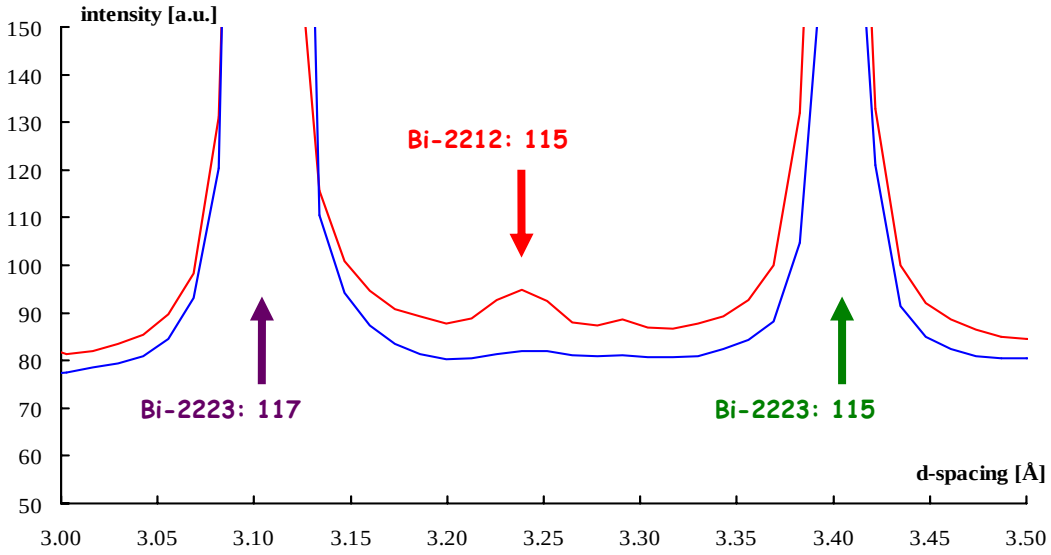

Fig. 1. Diffraction patern of a region with a relatively high Bi-2212 content (red) and a region with a low Bi-2212 content (blue). The 115 peak of Bi-2212 is situated between two large Bi-2223 peaks.

For every measuring point in the mesh, the measured X-ray diffraction patern has been integrated. A typical integrated spectrum is shown in Fig. 1. It shows the 115 peak of Bi-2212, which is the only one that does not coincide with a Bi-2223 peak. This peak was used for the analysis of the Bi-2212 content. The neighbouring peaks are Bi-2223 peaks and they are used for the analysis of the 2223 content.

Fig. 2. shows the variation in the content of both phases. These plots were obtained by fitting the peaks from the difftraction patterns with squared Lorentzian functions. From Fig. 2 it can be concluded that there is an appreciable local variation in the Bi-2212 content. These regions have typical scales of approximately 5-20 µm. This is both in absolute and in relative terms.

The details of the experiments are still being worked out.

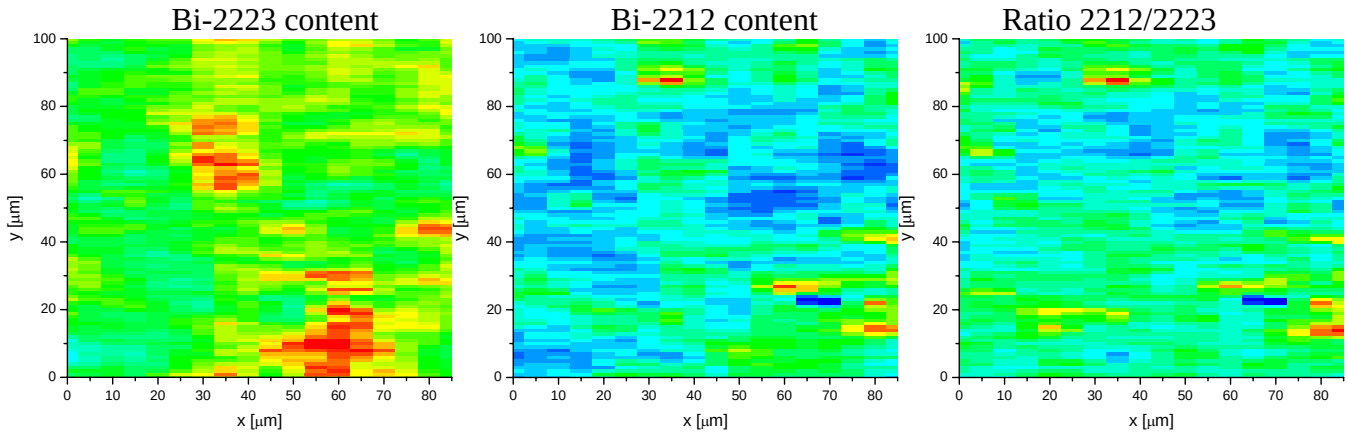

Fig. 2. Variation in Bi-2212 content in a region of 100x100 µm^2 related to the local Bi-2223 content. Red represents a high local content, blue represents a low local content and green an intermediate local content. On the scale of 5-20 µm clearly regions with higher and lower Bi-2212 content are observed.