Seamless Cu-Nb tubes are on of the candidates to manufacture accelerator units for a linear collider. The reasons for the study of Cu-Nb cavities are to reduce the fabrication cost and to decrease the amount of expensive niobium [1,2]. Another point of interest is the much better formability of copper compared to niobium. One can expect that copper dominates the formation process so that a cavity of high quality with constant wall thickness can be manufactured, which are problematic in highly pure niobium. The present example we will discuss here deals with explosive bonding of a copper tube with a niobium tube one of the favored processing techniques.

Figure 1 shows the Cu-Nb sample. A niobium tube was plugged into a copper tube. In the present case joining was achieved by explosive bonding. It has to be noticed that Cu and Nb do not form intermetallic compounds. A second possibility to join these two tubes is co-extrusion.

Fig. 1: Cu-Nb ring mounted at ID15

The Cu-Nb ring was cut from such a tube and consists of 1mm niobium as inner part encircled by 2 mm Cu. Using the white beam technique [3,4] we are able to scan with 100µm local resolution across the tube wall.

The data evaluation was complicated by the presence of preferred orientation and by the graininess. Particular copper is coarse grained and sometimes on the limit of a reasonable grain statistics. Figure 2 shows these two influences, which could be strong enough to eliminate completely the Cu (400) reflection.

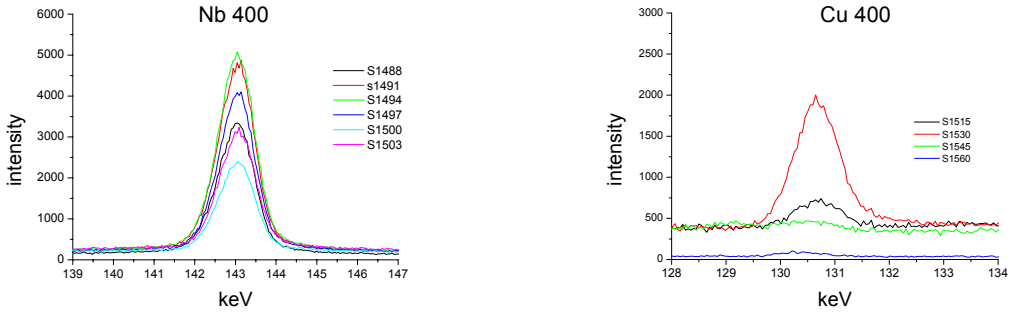
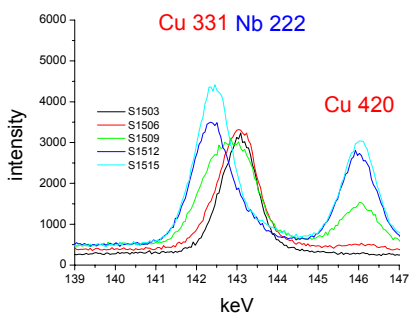


Figure 2: Intensity distribution of Nb (400) and Cu (400) for some sample positions

Three main results are obtained.



Firstly we a get information about the boundary of the two materials. The analyses of the overlapping of the two phases indicates the infiltration of copper in niobium of about 300 µm.

Fig. 3: Overlapping of Cu and Nb in the contact zone

Secondly we find out impurities in the Cu-part, which have not been identified up to know, see figure 4. It can be concluded that a copper alloy with precipitations and not highly pure copper was used for the production of the copper tube. It can be expected that these precipitations may have a great influence on the materials behaviour particular during annealing. It is a great achievement to have a method to study very low amounts of precipitations in a non-destructive way.

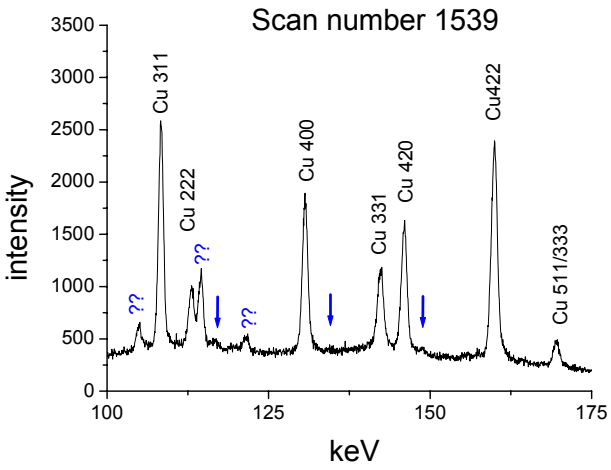


Fig. 4: Diffraction pattern of a selected sample position

Thirdly, we have calculated the strain distribution shown in figure 5. One can see three different regions in the Cu-Nb ring (Cu, Cu-Nb and Nb). In all regions no tendency to a gradient from copper to niobium was observed. The strains are balanced inside each region itself by different lattice plains. Thermal strains were expected after annealing and cooling.

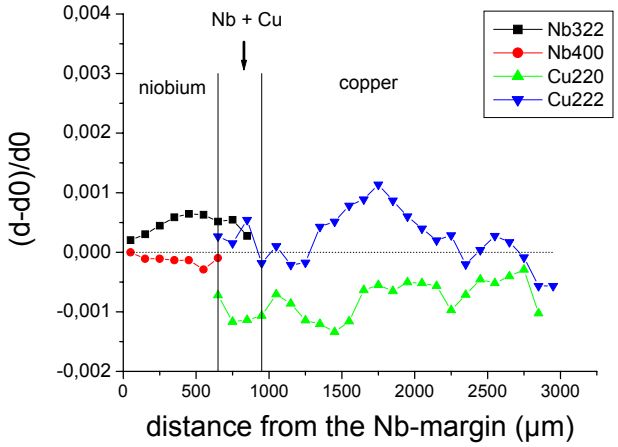


Fig. 5: Strain distribution of an explosive bonded Cu-Nb tube

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