Contribution ID: **17** Type: **not specified**

Determination of dislocations density in Cu-OFE for CLIC project by using EBSD

Wednesday 6 November 2013 14:30 (3h 30m)

In the frame of the CLIC (Compact Lineal Collider) Study, we are especially interested in a better understanding of the superficial modifications on oxygen free electronic copper (Cu-OFE) caused by the interaction with vacuum arcs at high gradient operation. Radio-frequency breakdown (BKD) phenomena are responsible of some of the surface damages observed in CLIC accelerate structures which are made out the cited material.
Recent finite element simulations carried out in Helsinki University about deformation on pure copper surface applying a force similar to the applied by an electric field, shows a relation between the BKD affected zone and the concentration of dislocations on the material. More generally, dislocations could have certain relation with the field emission sites even in areas away from BKD affected zones.
A crucial aspect of determining the role of dislocations in BKD is to find a diagnostic technique which determines their presence and/or density. The study of the bibliography presents the Electron Backscatter Diffraction (EBSD) like a valid technique for the assessment of the dislocation density in specimens subjected to a plastic deformation.

In EBSD, diffraction patterns are generated when electrons are diffracted by the lattice planes in the specimen and they are formed on a suitably placed phosphor screen. Patterns consist of a set of Kikuchi bands which are characteristic of the sample crystal structure and orientation.

In deformed samples the dimensions of crystal lattice are distorted (due to higher dislocation density), which leads to a greater angular distribution (variation) of the mentioned diffracted crystallographic planes that results in decreased Kikuchi band contrast and blurred Kikuchi band edges. This distortion of the EBSD pattern can be directly related with the residual strain of the specimen.

The aim of this study, therefore, is to legitimatise the EBSD technique for the determination of dislocation density in Cu-OFE and to establish, if it is possible, a relation between them and the BKD phenomena on this material.

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Session Classification: Poster session