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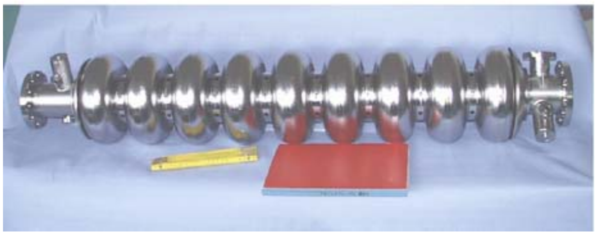

Production Calibration Defects

W. Singer, *DESY, Hamburg*

Work supported by the European Community-Research Infrastructure Activity under the FP6 "Structuring the European Research Area" programme (CARE, contract number RII3-CT-2003-506395).

Task 6.1   W. Singer   Date 12.08.04

Report: Production Calibration Defects

In order to make quantitative measurements and steadily control the sensitivity of a scanning device a test samples with artificially created inclusions of known size, situated at known locations were produced. It is well known that structure and electrical properties of pure tantalum are very similar to the same characteristic of pure Niobium. Therefore the detection of foreign inclusions of Ta is the hardest test for a scanning device. Test sheet with such defects can be used for device calibration.
Two test sheets from high purity Nb of 2.8 mm thickness were produced. In the first sheet the inclusions were located close to the surface, in the second sheet the inclusions are distributed in the bulk.

Bulk defects:
In the sheet with bulk Ta inclusions holes were drilled at eleven locations, small Ta spheres were embedded into the niobium, the holes were closed by carefully melting the surface of the sample in vacuum with an electron beam. After that the sheet surface were grinded and etched, so that the defects locations become invisible. The inclusions are located closer to one of the surfaces of the sample which was denoted as a "front side". Schema of the inclusion distribution can be seen in the Fig. 1 and the image of the SQUID scanning done at Institute of Applied Physics of University of Giessen can be seen in the Fig. 2

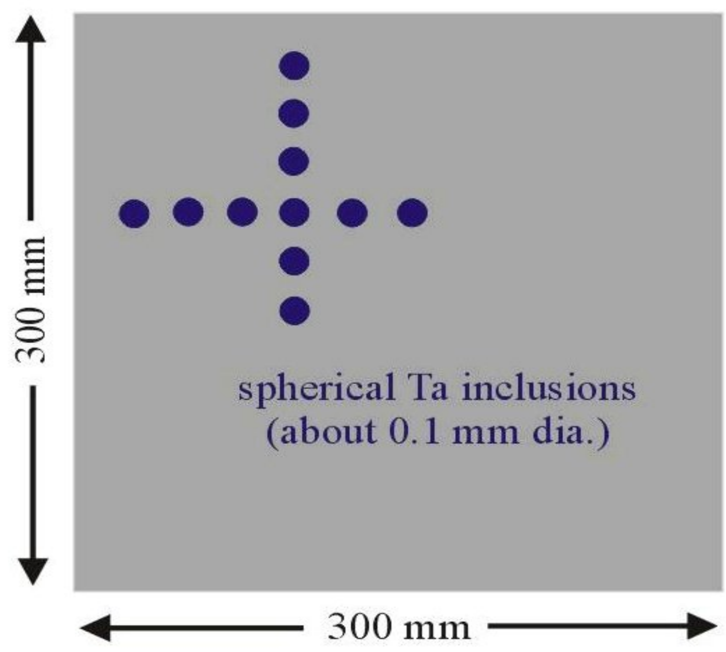

Fig. 1: Sketch of the test sample with bulk defects. Eleven Ta spheres with diameters of about 0.1 mm were embedded into a 30 × 30 cm^2 niobium sheet by electron-beam melting of the surface.

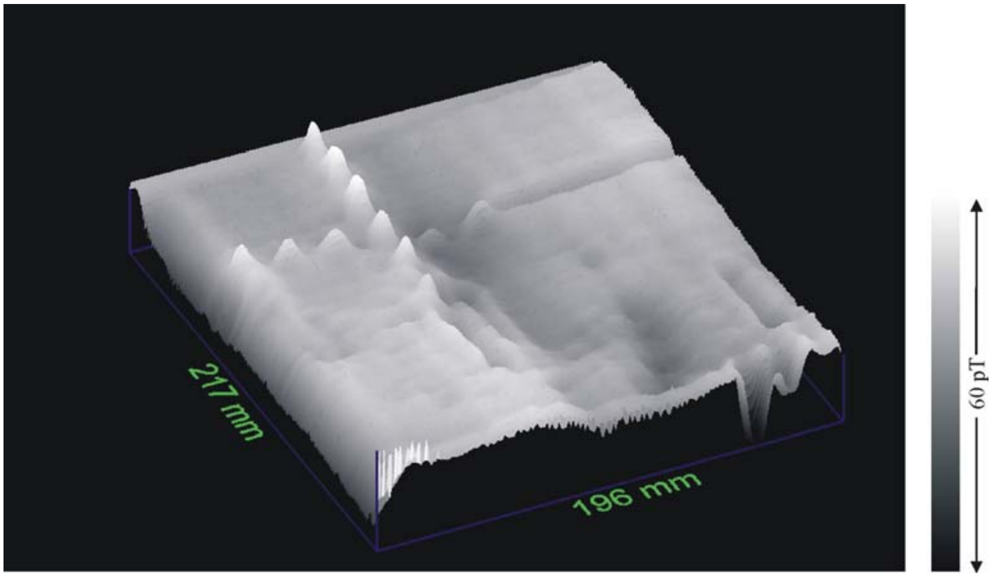

Fig. 2: Distribution of the eddy-current field above the niobium test sample. The eleven embedded Ta inclusions can be clearly seen

Surface defects:

The surface defects were produced by imbedding of small Ta particle (Ta powder) using a sharp needle and a light microscope. The biggest particle has the cross section diameter of about 150 µm and the smallest one is less than 50 µm in the size. Fig. 3 shows the results of SQUID device of Institute of Applied Physics of University of Giessen. Nine artificial surface flaws in the niobium sheet can be easily detected.

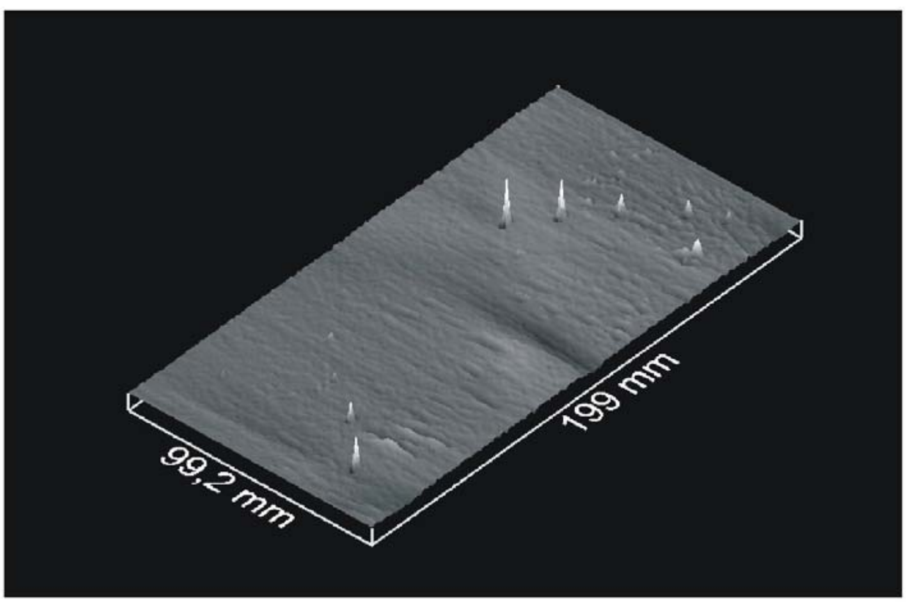

Fig. 3: Distribution of the eddy-current field of a test sample containing a number of surface flaws.