Flaw Evaluation in Copper Weldings with Computed Tomography

Jürgen GOEBBELS, Bernhard ILLERHAUS, Yener ONEL, BAM Berlin, Germany;
Hakan RYDÉN, SKP Sweden, Oskarshamn, Sweden;
Ulf RONNETEG, Bodycote CSM AB, Linköping, Sweden

Abstract. Detection of flaws in welds is one of the classical tasks of radiography. For establishing the reliability of UT techniques aimed for the quality control of copper canisters for final disposal of spent nuclear fuel, as basis for X-ray simulation and POD studies a precise location and size of the flaws inside the investigated samples is required which can be done using X-ray computed tomography, which gives a three-dimensional map of the volume properties.
Parts of copper canisters that has a nominal wall thickness of 5 cm which have been sealed using electron beam welded (EBW) and friction stir welded (FSW) were investigated with high energy computed tomography. The maximum copper thickness which had to be penetrated during the X-ray investigation was about 120 mm, therefore a 12 MeV electron linear accelerator was used. Due to the limited spatial resolution of the used flat panel detector (256x256 elements à 0.8x0.8 mm2) selected samples cut of the larger Cu parts are analysed with high resolution computed tomography. For this a 320 kV micro focal X-ray source could be applied together with an flat panel detector (1024x1024 elements à 0.4 x 0.4 mm2).
The measurements, the applied procedures of raw data correction and the image processing tools to transform the voxel based CT data in the ‘stl’-data format, which is commonly used in CAD and simulation applications are described. The size and location of the flaws inside the copper samples was determined from the ‘stl’-data format.
Measurements of well known artificial flaws are used to give information about the uncertainty in the measurement of the size of the flaws.